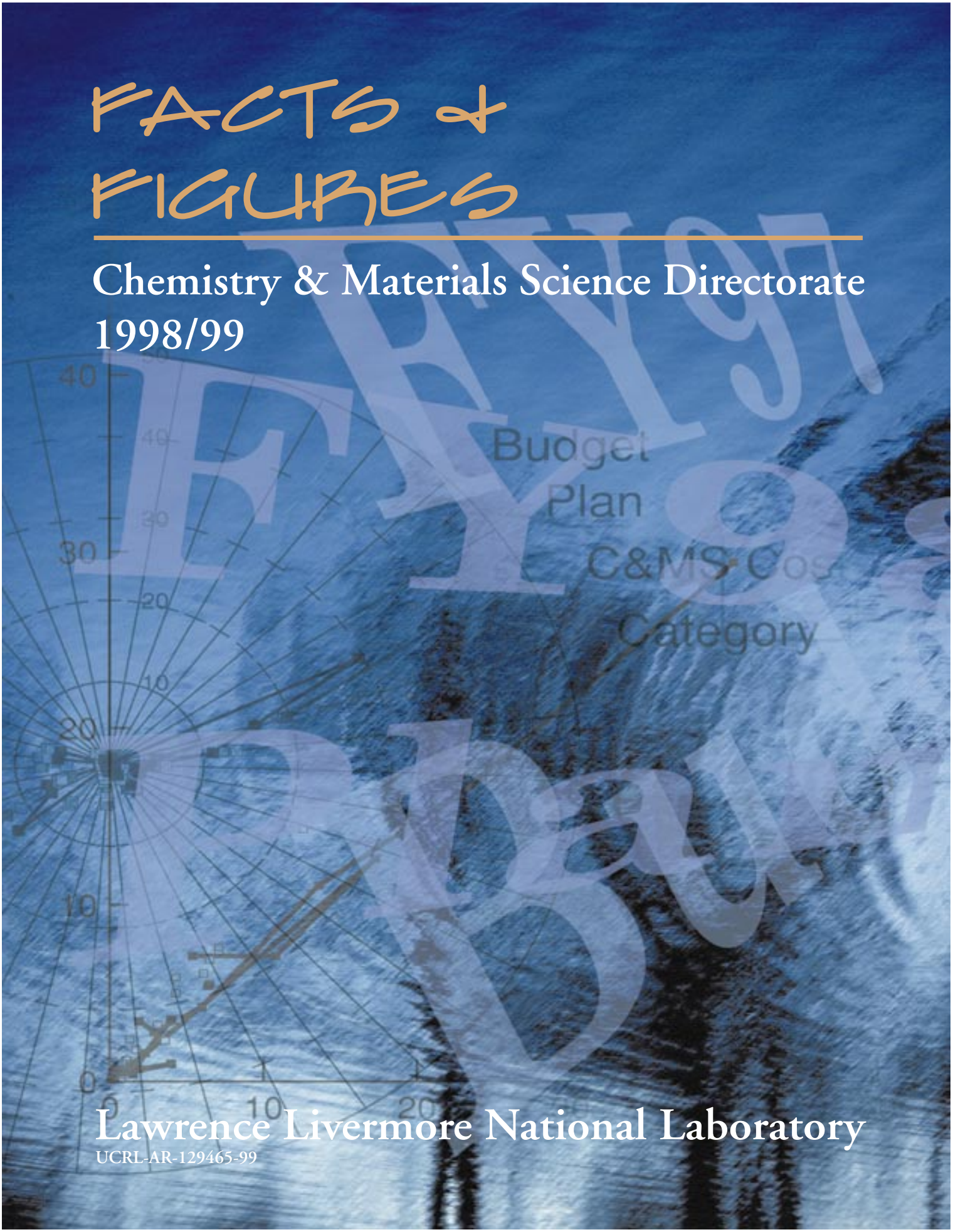
FACTS & FIGURES

Chemistry & Materials Science Directorate 1998/99



Lawrence Livermore National Laboratory
UCRL-AR-129465-99

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UCRL-AR-129465-99

Facts & Figures

1998/1999

Chemistry & Materials Science Directorate

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1. Introduction

Facts & Figures contains a broad overview of budgetary, personnel and other administrative information about Lawrence Livermore National Laboratory (LLNL) and specifically the Chemistry and Materials Science (C&MS) Directorate. For a more detailed, comprehensive overview of the Laboratory's mission, and expenditures, refer to the LLNL Institutional Plan @ http://www.llnl.gov/llnl/ip/

2. The Laboratory

About the Lab

Lawrence Livermore National Laboratory is a U.S. Department of Energy national laboratory operated by the University of California.

Mission

LLNL is a premier applied-science national security laboratory. Its primary mission is to ensure that the nation's nuclear weapons remain safe, secure, and reliable and to prevent the spread and use of nuclear weapons worldwide.

This mission enables Lab Programs in advanced defense technologies, energy, environment, biosciences, and basic science to apply their unique capabilities and to enhance the competencies needed for the national security mission.

The Laboratory serves as a resource to U.S. government and a partner with industry and academia.

Vision and Goals

The Laboratory's goal is to apply the best science and technology to enhance the security and well being of the nation and to make the world a safer place.

Financial and FTE Highlights

Fiscal Year (FY) 1998 operating and capital expenses totaled $1,230.6M. This included $1,034.6M for the Laboratory operating budgets and $196.0M for construction, equipment and general plant projects. FY99 operating and capital budgets are projected to be $1,346.3M (see Table 1 for a breakdown of financial information by major program). The staffing level as of September 30, 1998, was 7,155 full time equivalents (FTEs), including full-time, part-time, and indeterminate time employees. As of November 30, 1998, planned FTEs are 7,246 (see Table 2). FTEs, a term used to describe a full-time employee who, during the course of a year, takes an average amount of vacation, sick

Table 1. Laboratory Costs by Major Program ($M).

Category	FY98 Actual ($M) 9/30/98	FY99 Plan ($M) 11/30/98
LLNL Major Program		
DP01—Weapons Core Stockpile Stewardship	330.7	385.4
DP04—Weapons Stockpile Management	38.0	36.9
Technology Transfer / Education	6.8	5.8
DP02—Inertial Confinement Fusion (ICF)	85.2	92.0
National Ignition Facility (NIF)	53.2	20.0
GA—Fissile Material Dispositon	19.8	20.0
Non-Proliferation & Intelligence	76.1	92.4
Environmental Restoration & Waste Management	47.6	50.9
Other Defense	14.1	14.1
HG—U-AVLIS (USEC)*	60.0	0.0
Magnetic Fusion	9.9	9.2
NER Supercomputer Center	0.0	0.0
Biomedical & Environmental	28.3	32.1
Basic Energy Science (BES)	10.3	12.6
Energy Research	14.0	14.1
Subtotal DOE Direct Operating	**794.1**	**785.6**
WFDOE	81.0	72.1
Non-DOE	159.6	196.2
Total Direct Sponsor Funded Operating	**1,034.6**	**1,053.9**
Capital		
Major Items of Equipment	3.3	0.4
DOE Equipment**	0.0	0.0
DOE GPP	7.9	7.6
DOE Line Item Construction	27.6	54.3
National Ignition Facility Capital	157.2	230.0
Total Capital	**196.0**	**292.3**
Total LLNL Operating & Capital	**1,230.6**	**1,346.3**

*HG-U-AVLIS (FY96-97 Costs funded in Non-DOE from USEC).
**In FY1998 DOE Basic Equipment is not included in Operating, consistent with DOE / Congressional funding process.

Table 2. Laboratory FTE Plans by Major Program.

Category	FY98 Actual 9/30/98	FY99 Plan 11/30/98
LLNL Major Program		
DP01—Weapons Core Stockpile Stewardship	864.6	947.2
DP04—Weapons Stockpile Management	79.3	117.2
Technology Transfer / Education	32.4	22.4
Inertial Confinement Fusion (ICF)	197.1	255.2
National Ignition Facility Operating (NIF)	41.2	31.7
GA—Fissile Material Disposition	58.6	60.3
Non-Proliferation & Intelligence	190.8	263.7
Environmental Restoration & Waste Management	186.4	197.0
Other Defense	40.7	39.3
HG—U-AVLIS (USEC)	0.0	0.0
Magnetic Fusion	32.5	35.9
Biomedical & Environmental	114.1	152.1
Basic Energy Science (BES)	21.6	26.9
Energy Research	36.4	40.0
Subtotal Doe Direct Operating	**1,895.6**	**2,188.9**
WFDOE	238.8	254.8
Non-DOE	625.8	640.8
Total Direct Sponsor Funded Operating	**2,760.2**	**3,084.5**
Capital		
DOE Construction / Equipment	81.9	44.9
NIF Capital	391.3	344.1
Total Capital	**473.2**	**389.0**
Distributed Direct Support		
Lab Directed R&D (LDRD)	321.5	271.1
Distributed Services	915.0	916.0
Organization Facility (OFC)	224.2	237.4
Organization Personnel (OPC)	617.7	547.5
Program Management (PMC)	324.3	333.1
Total Distributed Support	**2,402.7**	**2,305.1**
General & Administrative (G&A)	1,519.3	1,467.2
Total LLNL Operating & Capital	**7,155.4**	**7,245.8**

leave, and other leave in addition to normal holiday leave. Therefore, FTE totals are not equivalent to number of employees.

Between FY89 and FY98, the Laboratory operating costs increased 8.5% while staffing levels decreased 15%, (see Figures 1 and 2).

Staffing and Demographics

As of December 31, 1998, the LLNL workforce (by head count) is 8,838. This workforce is comprised of 75% career, 10% non-career, 1% post doctoral, 3% student, 2% retiree and 9% supplemental labor (see Table 3). The staff profile of career employees (excluding summer hires and temporary program participants) showed 39% scientific staff, 24% administrative and clerical, and 37% technical and crafts personnel. About 46% of the scientists and engineers have a Ph.D. (see Table 4). The scientific staff by Discipline is shown along with Post Doctoral Labor (see Table 5).

Figure 1. Ten-Year Laboratory Operating Costs.

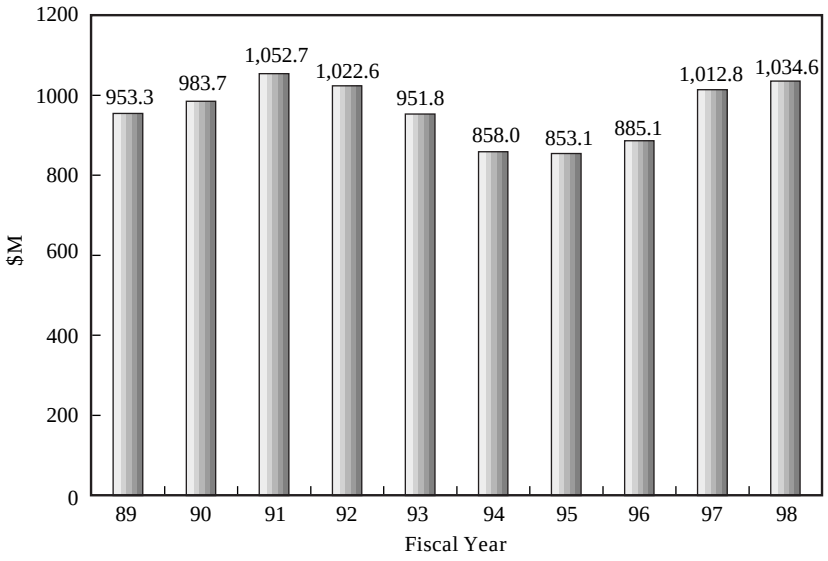
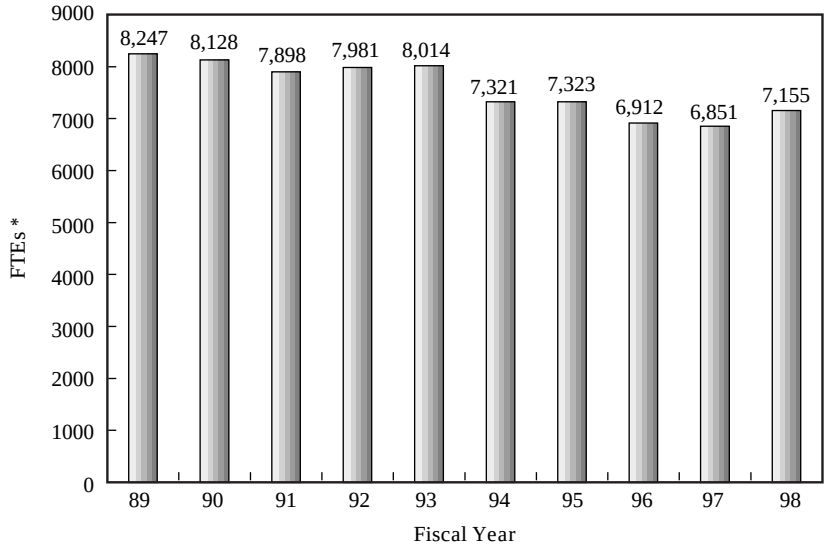


Figure 2. Ten-Year Laboratory FTEs.



*Full Time Equivelantdoes not include Post Doctorals or Retirees

Table 3. LLNL Workforce.

LLNL	Heads
Career	**6,589**
Full-Time	6,297
Part-Time	215
Leave of Absence	77
Non-Career	**922**
Term (Full-Time)	361
Term (Part-Time)	65
Indeterminate	102
Flex Term	390
Leave of Absence	4
Total LLNL Career and Non-Career	**7,511**
Post Doctorals	125
Retirees	190
Students	230
Graduate Students	20
Student Trainees	86
Summer Hires	123
Co-ops	1
Total Other Labor LLNL Employed	**545**
Supplemental Labor	782
Total Other Labor non-LLNL Employed	**782**
Total Laboratory Heads	**8,838**

Dated: December 31, 1998.

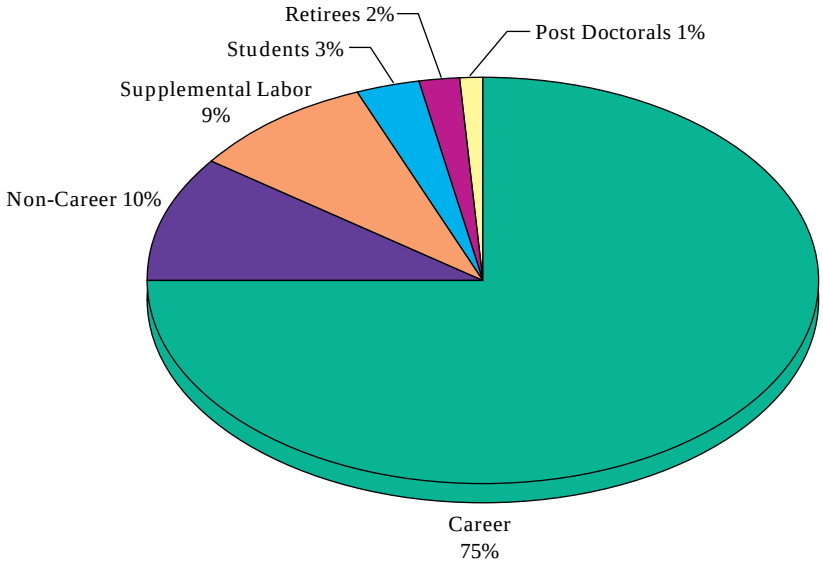


Table 4. LLNL Staff Profile by Job Title and Degree Composition.

Job Title	PhD	MS	BS	AA	No Degree	Total	Staff %
Scientists & Engineers	**1,220**	**783**	**585**	**5**	**46**	**2,639**	**39%**
Physicist—(270)	654	86	28	0	2	770	
Chemist—(242)	128	33	40	0	0	201	
Engineer / Patent Engineer—(168,249)	272	412	235	3	18	940	
Mathematician / Computer Scientist—(256, 285)	87	196	235	2	24	544	
Biological Scientist—(221,225,235,277)	22	14	16	0	0	52	
Environmental Scientist—(230)	17	31	27	0	0	75	
Metallurgist—(265)	26	6	2	0	2	36	
Medical Doctor—(263)	6	0	0	0	0	6	
Political Scientist—(295)	8	5	2	0	0	15	
Administrative & Clerical	**31**	**175**	**305**	**133**	**965**	**1,609**	**24%**
Management—(196,197)	16	53	32	2	15	118	
Professional—(163-165,169,170)	6	26	27	1	13	73	
Administrative —(100-162)	9	95	204	71	356	735	
Clerical / General Services—(400-462)	0	1	42	59	581	683	
Technical & Crafts	**1**	**29**	**327**	**695**	**1,404**	**2,456**	**37%**
Security / Fire Department—(051,055,650-656)	0	1	23	40	147	211	
Technical—(302-339,347-391,502-588)	1	28	291	583	856	1,759	
Facility / Trades—(700,701,704,722-799,801,805-990)	0	0	13	72	401	486	
Total Laboratory Heads	**1,252**	**987**	**1,217**	**833**	**2,415**	**6,704**	**100%**

NOTE: Excludes summer hires & temporary program participants.
Dated: December 31, 1998.

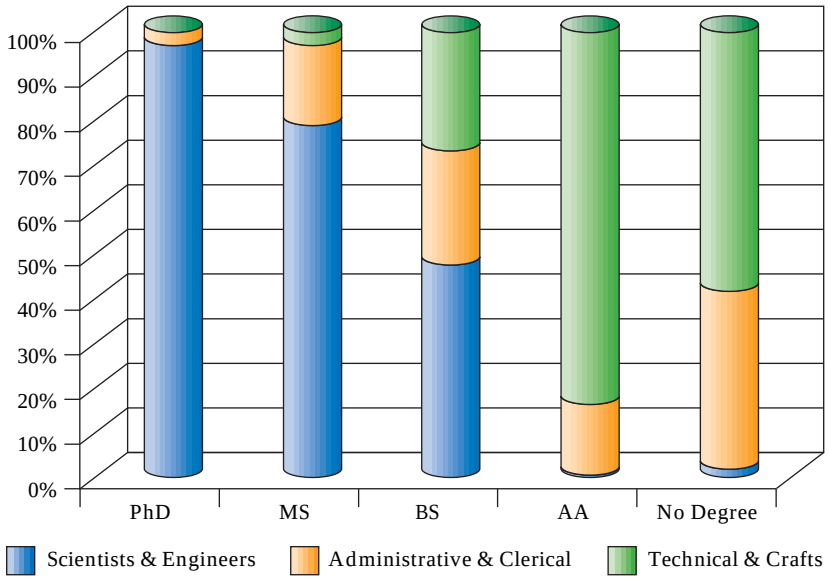
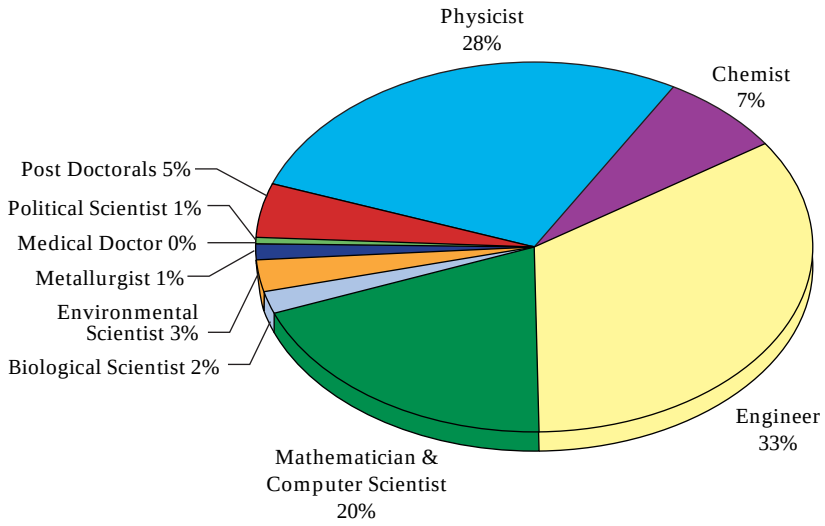


Table 5. LLNL Scientists & Engineers by Discipline and Post Doctorals.

Job Title	Heads	(%)
Scientists & Engineers	**2,639**	**95%**
Physicist—(270)	770	28%
Chemist—(242)	201	7%
Engineer / Patent Engineer—(168,249)	940	33%
Mathematician / Computer Scientist—(256, 285)	544	20%
Biological Scientist—(221,225,235,277)	52	2%
Environmental Scientist—(230)	75	3%
Metallurgist—(265)	36	1%
Medical Doctor—(263)	6	0%
Political Scientist—(295)	15	1%
Post Doctorals	**125**	**5%**
Total Laboratory Heads	**2,764**	**100%**

Dated: December 31, 1998.



Operations

Figure 3 shows the matrix system of management used to operate the Laboratory. The major function "Program Directorates" are shown horizontally, and the "Program Support Directorates" are shown vertically to illustrate the matrix operation and cross-affiliation. Each Program organization is headed by an Associate Director (AD). The Service Organizations report through the Deputy Directors and include services such as Plant Operations, Controller, Legal Council, etc. Most of the support Directorate staff are assigned to work in one of the Programs, i.e., matrixed to a Program Directorate. Programmatic work assignments for an individual can change from time to time, but the administrative home tends to remain relatively constant.

Organization

No standardized organizational structure exists within the Program and Support Directorates. Each Directorate is organized by its AD to more efficiently meet the needs and mission of the organization (see Figure 4).

Figure 3. LLNL Organizational Matrix.

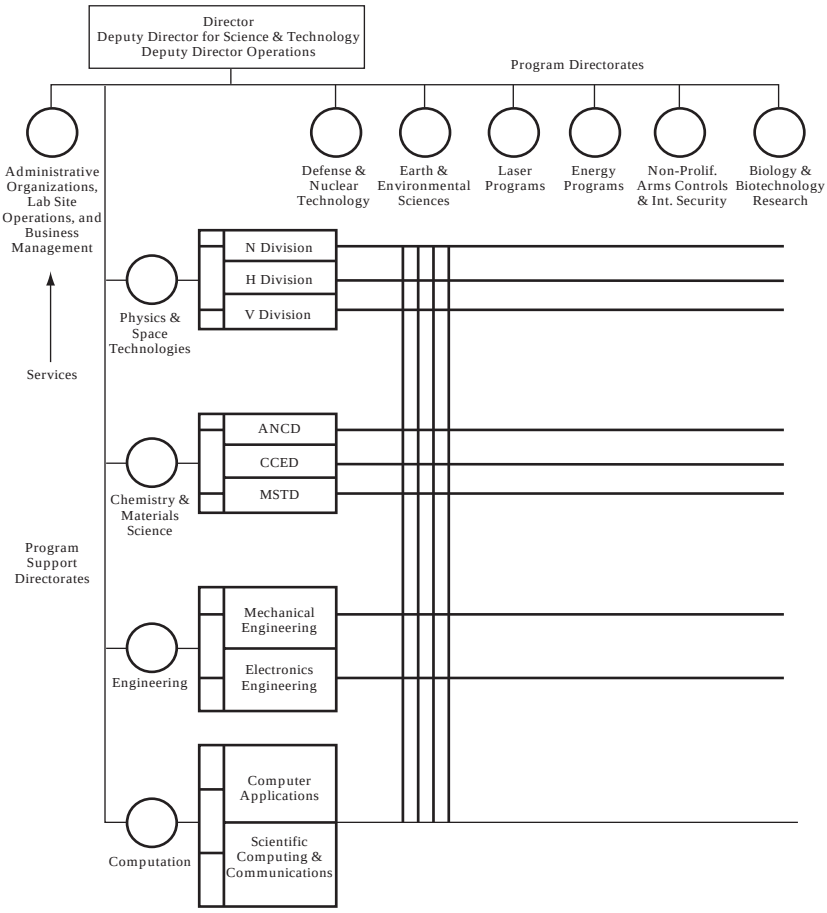
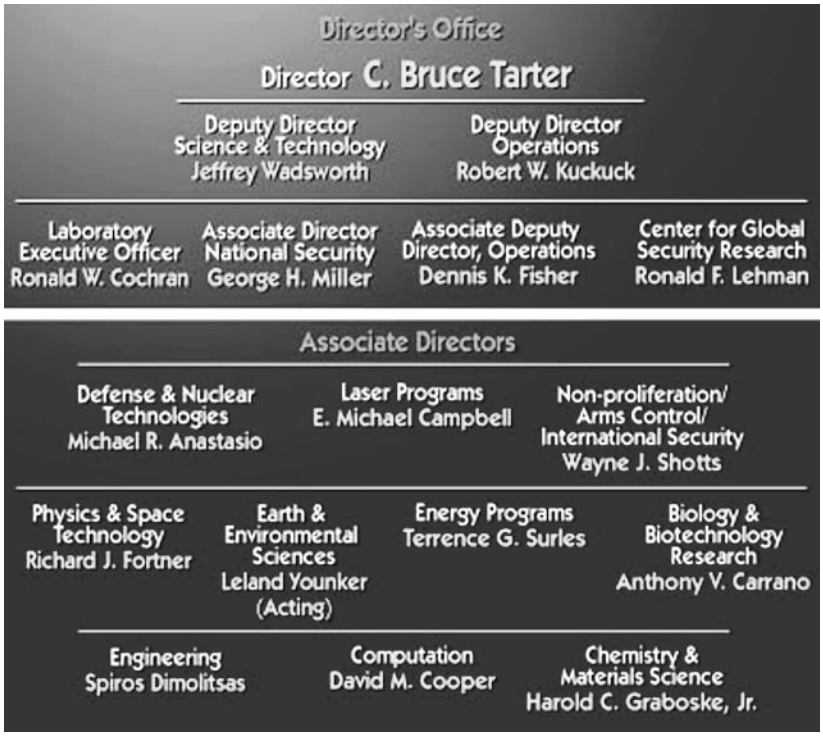


Figure 4. LLNL Organizational Chart.



3. Chemistry and Materials Science (C&MS) Directorate

Mission

- To be the primary provider of materials science and chemistry vital to the success of Laboratory Programs.
- To lead the development and enhancement of expertise in materials science and chemistry for the Laboratory.

Year 2002 Vision

- C&MS is the cornerstone of LLNL's nationally recognized excellence for material and chemical sciences.
- The Lab and its Programs view C&MS as a highly valued, relevant partner and as the preeminent provider of effective materials and chemistry solutions required to assure success of their missions.
- C&MS has outstanding technical and operations/administrative staff with state-of-the-art research and facilities for long-term institutional excellence.

Operations

The scientific and technical discipline activities of the Directorate can be divided into three broad categories:

- C&MS staff are assigned to work directly in a Program—a matrix assignment typically involving short deadlines and critical time schedules.
- The development, management and delivery of analytical, characterization, measurement, synthesis, processing and computing capabilities and scientific services to Programs.
- Longer-term research and development activities in technologies important to Laboratory Programs, determining the focus and direction of technology-based work on programmatic needs (as shown later in Table 13).

History, Organization, and Administration

Since the Laboratory's inception in 1952, Chemistry as a discipline has been identified as a separate organization (see Figure 5). It has been called Chemistry Group, Chemistry Division, Chemistry Department, Chemistry and Materials Science Department, and since 1985, the Chemistry and Materials Science Directorate.

The organization has evolved and expanded its technical breadth and depth over time focusing on a broad span of materials sciences. The organization now houses the institutional focus on a broad base of chemical, analytical, and the materials sciences experimental and computational expertise and capabilities.

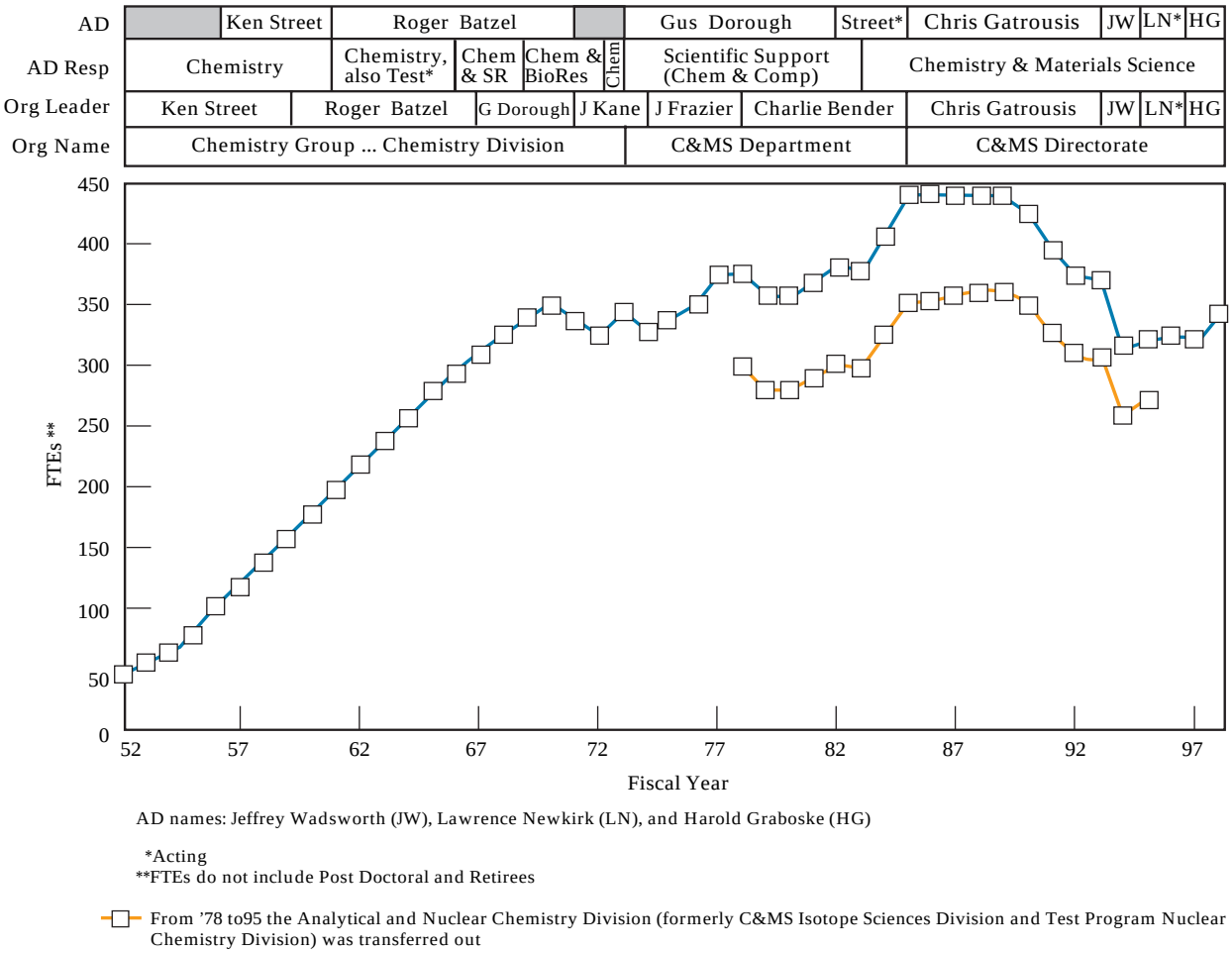
In March 1997, Dr. Harold Graboske, Jr. was named Associate Director (AD) for C&MS.

Figure 6 shows the current C&MS organization. The AD office includes Infrastructure activities that span the Directorate spectrum. The scientific and technical activities of the Directorate are conducted in the divisions. The Infrastructure includes functions such as administration, resource management, materials program leaders, facility operations, personnel, assurances, and computer support.

Figures 7 through 10 (as shown at the end of this section) are organization charts for Directorate Operations and the three divisions: Analytical and Nuclear Chemistry, Chemistry and Chemical Engineering, and Materials Science and Technology. Names of sub-units within the divisions are program elements or scientific capabilities.

In November 1990, the C&MS AD proposed the establishment of an Institute for Transactinium Science (ITS) to be sponsored by LLNL and the Lawrence Berkeley National Laboratory in collaboration with the University of California, Berkeley. Formal announcement of the Institute, named in honor of Professor Glenn T. Seaborg, was made in February 1991. The Institute is centered at Livermore and is devoted to the study of the transactinium elements with special emphasis on the education and training of the future generation of scientists in heavy-element research.

In pursuit of this goal, the ITS is currently establishing stronger ties to the defense and environmental programs at LLNL to address their needs for future actinide experts and help with current projects. In 1996, the charter director of the ITS, Darleane C. Hoffman, retired from this post and was succeeded by Louis J. Terminello. The ITS reports through the Analytical and Nuclear Chemistry Division in C&MS. See the ITS web page @ http://www-cms.llnl.gov/its/



AD names: Jeffrey Wadsworth (JW), Lawrence Newkirk (LN), and Harold Graboske (HG)

*Acting
**FTEs do not include Post Doctoral and Retirees

From '78 to95 the Analytical and Nuclear Chemistry Division (formerly C&MS Isotope Sciences Division and Test Program Nuclear Chemistry Division) was transferred out

Figure 5. C&MS History.

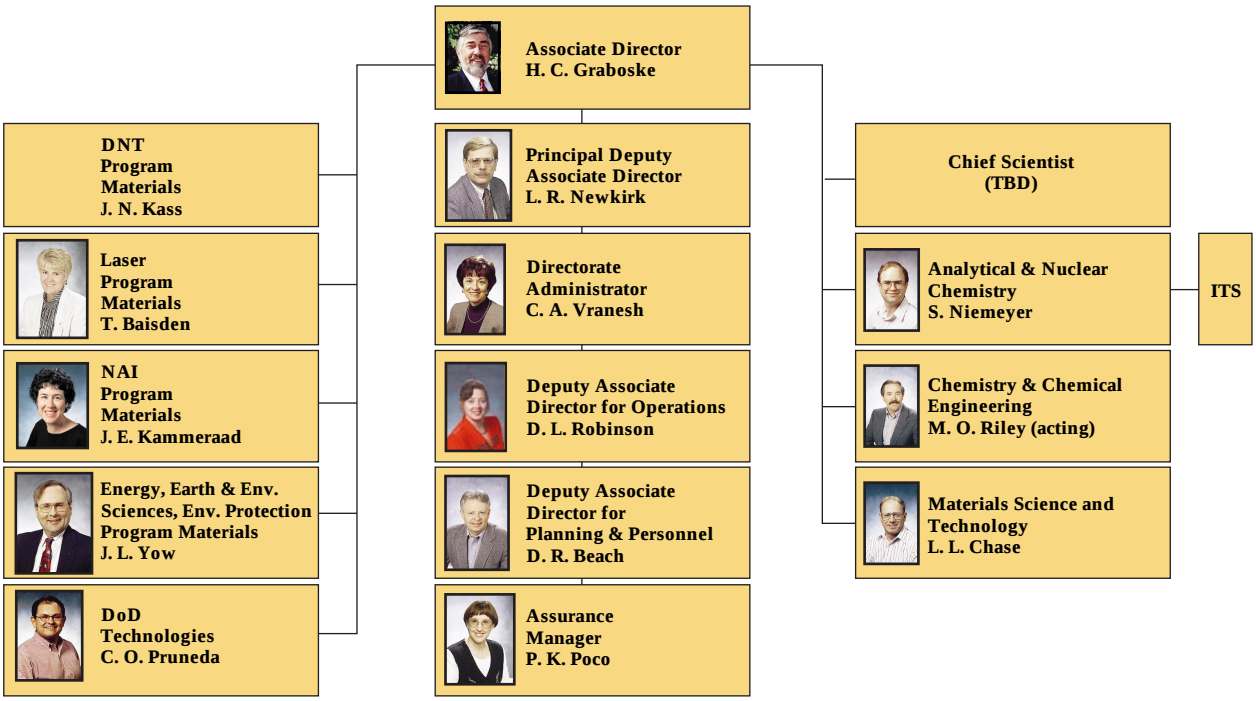


Figure 6. Organizational Structure of the C&MS Directorate.

Strategic Plan

During the summer of 1997, the Directorate conducted a series of strategic planning and evaluation sessions looking at the effectiveness of its interactions with the Program Directorates and internally at research and infrastructure. New vision, mission statement and implementation plans to address the issues and concerns were developed. One of the outcomes was a desire to strengthen C&MS interactions with the Program Directorates.

Strategic Plan Initiatives Implemented

Established Materials Computation, Analysis, & Processing (MCAP)

Mission—focus C&MS core capabilities to solve key LLNL materials problems.

Responsibilities—Strategic lifecycle management and investment in C&MS scientific capabilities to sustain and enhance their value to the Laboratory's mission and Programs.

Accomplishments—consist of:

- Major investment in C&MS computational capabilities, both silicon and people.
- Managed $1.6M of IGPE investment in C&MS capabilities.
- Redesigned FY99 Institutional General Purpose Equipment (IGPE) portfolio process to incorporate multi-program interests and input from Material Program Leaders.
- Transitioned approximately $4M of capability activities to a recharge mechanism.
- Weaknesses in capability leadership identified and incorporated into C&MS recruiting plans.
- FY98 IGPE investments:
  - — Glow Discharge Mass Spectrometer ($468K),
  - — High Field NMR ($540K),
  - — Four Circle Goniometer for XRD ($211K),
  - — LC-ITMS for Bio-MS ($218K),
  - — CHNOS Elemental Analyzer ($50K), and
  - — CP-ES ($123K).

FY99 Strategic Actions—include:

- Develop / improve capability recharges.
- Better and more consistent business practices.
- Improve quality and customer satisfaction.
- Establish strong capability leaders or develop sunset plans for that capability.
- Improve the marketing of C&MS capabilities.
- Develop formalized investment strategies (IGPE, G&A, recharge, and program $'s).
- Enhance and focus scientific computing tools.

Established a Post Doctoral Program

Goals—consist of:

- Professional and Career development—to give post-doctoral associates in C&MS a broad and career enhancing experience, exposing them to a wide variety of research, facilities and people.
- Improved lab interface—historically, post-docs have had a difficult time integrating quickly into the culture of LLNL. The post-doc program provides a resource for information, needs and guidance in how to navigate LLNL and be as efficient as possible in research and job requirements. Also, general LLNL and C&MS information (lab mission, major programs, other lab opportunities, etc.) is disseminated via the post-doc program.
- Greater exposure to lab facilities—LLNL has research and resource facilities virtually unique to any other laboratory in the country. The post-doc program can help facilitate the interactions of C&MS post-docs and these facilities, providing points of contact and other specific information.
- Enhance research profile and portfolio—by bringing in a greater variety of post-docs with diverse disciplinary training, we are increasing our "talent pool" and the depth of our scientific capability available to us and our customers (the programs) scientific and technological needs.
- Improve current and future contacts with the "outside"—by making a post-doc's experience at LLNL a positive one, we improve and increase our credentials and reputation as a world-class laboratory of science. Especially when a previous C&MS post-doc becomes a professor, industrial contact, etc— this person then becomes a source for future talent and post-docs as well as an unofficial representative of our directorate.

Established five Materials Program Offices to strengthen interactions with Program Directorates. Focusing on the following key areas:

Stockpile Stewardship Management Program (SSMP)—C&MS Materials Program Leader, Jeff Kass.

C&MS supports many of the stockpile stewardship tasks and programs conducted by the Defense and Nuclear Technologies (D&NT) Directorate. These tasks and programs enhance U.S. defense capabilities through innovative materials and chemical R&D and the application of new science and technology to issues of concern to the U.S. Defense community. We assist all D&NT organizations with strategic planning efforts as required, new program initiatives, and scientific reviews.

Program representatives are: Dick Lear for B-Program, Dave Stanfel for A-Program and Steve Root for W-Program. C&MS participants and their program functions are John Kolb (Deputy MPL and A-Program), Jim LeMay (Deputy MPL and compatibility), Gil Gallegos (Pu/U and B-Program), Al Lingenfelter (Pu/U), Bill Wolfer (Modeling), Sid Niemeyer (Radchem), Ron Lougheed (Radchem), Jon Maienschein (High Explosives [HE]), Randy Simpson (HE), and Ron Atkins (HE).

The goals of the SSMP Materials Program Office are extensive. These goals include but are not limited to:

- Provision of oversight and coordination for all C&MS support to Stockpile Stewardship (A, B, and W Programs).
- Provision of the highest quality staffing and training for programmatic work.
- Planning and execution of R&D required for programmatic success.
- Assistance in identifying and providing required capital equipment.

Keys in achieving these goals are assurance that lab and experimental activities are cost-effective and high quality, providing suitable input to allow proper C&MS staff administration and facilitation of effective two-way communications of program goals, issues and progress.

C&MS provides D&NT programs with about 100 FTEs of assigned matrix support. The Nuclear Component Materials and Chemistry funding, Tech Base funding and LDRD tasks provide direct program support, reduction to practice and forward-looking research, respectively. The crucial Nuclear Component Materials and Chemistry area will expend roughly $6.3M during the current fiscal year. Due in large part to the growth of the overall funding level, the SSMP office has strengthened the coordination of C&MS work internally as well as facilitated better communications. We have moved top people into crucial D&NT assignments in HE, compatibility, Pu metallurgy and aging and radiochemistry.

Five focus areas of intense investigation under the Nuclear Component Materials and Chemistry umbrella that we will continue to investigate in FY99 are:

- Compatibility efforts,
- Dual revalidation projects,
- Accelerated aging efforts for plutonium,
- Safety assessments, and
- HE safety/properties/retention of synthesis capability.

FY99 Technology Development projects related to SSMP interests include:

- Cushion diagnostics,
- Analysis of older B-Program experiments,
- HE synthesis, and
- Cross section studies.

Under the auspices of LDRD, the SSMP Office helped to:

- Investigate aging effects and defect structures in Plutonium,
- Experimentally validate theoretical interatomic potentials,
- Map enhanced nuclear stability in the heaviest elements,
- Apply molecular dynamic calculations to HE safety, and
- Apply aerogel technology and synthesize new nanostructure HEs.

Laser Programs—C&MS Materials Program Leader, Trish Baisden.

The C&MS Directorate provides Laser Programs with about 40 FTEs of assigned matrix support.

The National Ignition Facility (NIF) will produce conditions where nuclear fusion reactions may be studied and materials tested at extreme temperatures and pressures. Chemists, physicists, material scientists, and chemical engineers in C&MS work in an integrated fashion to develop and field optical materials for high peak power lasers. Some examples include:

- Continuous melting technology for laser glass;
- Rapid crystal growth technology for KDP (potassium dihydrogen phosphate);
- High-speed, deterministic polishing of fused silica lenses and windows;

- Diffractive optics fabrication for beam uniformity and color separation;
- Fabrication of inertial fusion targets in support of energy research and defense programs;
- Precision cleaning and anti-reflection coatings for optical components.

FY99 Technology Development projects related to Laser Programs' interests include:

- Omega Sampling,
- To be determined.

Non-proliferation/Arms Control/ International Security (NAI)—C&MS Materials Program Leader, Judy Kammeraad.

The NAI Mission is to support the U.S. government and international agencies in their efforts to reduce the danger from nuclear weapons and other threats from weapons of mass destruction.

The NAI Materials Program Office objectives:

- To promote the success of NAI programs by facilitating NAI-C&MS interactions,
- To provide technical experts,
- To coordinate collaborative research,
- To assist in program development,
- To build or enhance key C&MS capabilities.

MPO Team (and interface) members: Melanie Elder (Z Division), Pat Grant (Forensic Science Center), Judy Kammeraad, Cesar Pruneda (DoD-related activities), Wayne Ruhter (PPAC), and Chuck Stevens (Q Division).

About 35 C&MS personnel are working intensively in the following NAI program elements:

- Forensic Science;
- Proliferation Prevention & Arms Control;
- Chemical / Biological Warfare (CW / BW) Signatures, Detection, and Analysis (emerging).

Current MPO priorities include:

- Identify areas for cooperative CW / BW program growth, team with key NAI and C&MS personnel to pursue selected opportunities.
- Promote one or more new joint LDRD projects in NAI-related research.
- Undertake the development of selected capabilities ("technology development") that aid NAI and other programs.
- Promote strategic investment of IGPE funds to build C&MS capabilities that aid NAI and other programs.
- Assist NAI in finding excellent personnel for the CAPS program.
- Help NAI with programmatic long range planning.
- Help NAI deliver on the Gamma-Ray Imaging LDRD project.
- Continue to aid the Forensic Science Center by providing technical experts, managing the matrix environment effectively, and promoting the enhancement of key technical capabilities.

FY99 Technology Development projects related to NAI interests include:

- "Pathogen Detection by Multiplex PCR Analysis using Mass Tags and Electrospray Ionization Mass Spectrometry", Phillip Belgrader and Hugh Gregg;
- "Development of Thin-Layer Chromatography (TLC)—Laser Desorption / Ablation Mass Spectrometry Analysis Technique", Greg Klunder.

Energy, Earth & Environmental (E^3)—C&MS Materials Program Leader, Jesse Yow.

The C&MS Directorate supports energy and environmental programs conducted by the Energy Programs Directorate, Earth and Environmental Sciences Directorate, and Environmental Protection Department at LLNL. These programs enhance US energy and environmental security through innovation and the application of science in three cross-linked and highly multidisciplinary program areas:

Nuclear Materials Stewardship, including:

- High-level nuclear waste disposition, including nuclear waste repository R&D;
- Uranium and plutonium materials processing and isotope separation;
- Advanced nuclear energy systems;
- Proliferation resistant fissile materials systems;
- Nuclear systems safety.

Energy Generation, Use, and Effects, including:

- Multi-scale (temporal and physical) atmospheric modeling;
- Carbon utilization, sequestration, and management;
- Methane hydrates and alternative fossil energy technologies;
- Advanced transportation and utility systems for energy conversion, storage, and use;
- Advanced manufacturing technologies.

Environmental Security and Risk Reduction, including:

- Environmental monitoring and assessment,
- Cleanup and remediation technologies,

- Critical energy and environmental infrastructure protection,
- Water resource diagnostics and modeling,
- Advanced fuel system modeling and assessment.

C&MS provides energy and environmental programs with about 40 FTEs of assigned matrix support. About 25 additional staff members support these programs through recharged analytical services.

LDRD projects related to energy and environmental interests include:

- A General Method for Coupling Atomistic to Continuum Mechanics Simulations with Application to Stress Corrosion Cracking, Andrew Quong and Wilhelm Wolfer.
- Chemical Aspects of Actinides in the Geosphere: Towards a Rational Nuclear Materials Management, Patrick Allen.
- Diagnostic Systems Approach to Watershed Management, Lee Davisson, Bryant Hudson, Jean Moran, Carolyn Koester, and Gail Eaton.
- Effects of Radiation on the Mechanical Properties and Structural Integrity of Nuclear Materials, Tomas Diaz de la Rubia, Vijay Shastry, Eduardo Alonso, Andrew Quong, and Michael Surh.

Technology Development projects related to energy and environmental interests include:

- Airborne Particulate Model Validation Capability, Eric Gard and Howard Hall.
- Exploratory investigation of selective organic solvent removal from water by aerogel material, Larry Hrubesh and Joe Satcher.
- Feasibility of Laser Peening to Reduce Residual Tensile Stresses in Welded Nuclear Waste Containers, Al Lingenfelter, Don Stevens, Bill Clarke, and Lloyd Hackel.
- Field Investigation of Radionuclide Transport: The NTS as a Natural Laboratory, Annie Kersting and Dave Smith.

The Materials Program Office supports the Energy Programs Directorate, Earth and Environmental Sciences Directorate, and Environmental Protection Department by:

- Providing the interface between energy and environmental programs and C&MS.
- Assisting energy and environmental organizations with strategic planning, new program initiatives, and scientific review.
- Coordinating scientific and technical staffing and recruiting to ensure responsive support.
- Facilitating energy and environmental program access to C&MS capabilities, laboratories, and facilities.
- Coordinating research and technology development to anticipate and meet energy and environmental programmatic needs.

In addition the MPO assists energy and environmental program development by:

- Helping identify potential sponsors, develop proposals, and plan marketing efforts.
- Communicating program needs and opportunities to C&MS personnel and organizations.
- Highlighting C&MS ideas and capabilities to energy and environmental program leaders for possible use in new initiatives.

Department of Defense (DoD) Technologies—C&MS Materials Program Leader, César O. Pruneda.

The objective of this office is to expand the C&MS Directorate's portfolio of Department of Defense (DoD) projects and to coordinate non-DoD work-for-other (WFO) activities. The science and technology applied in the DoD and WFO projects serve to enhance and build C&MS competencies which support laboratory programs in national security, energy and environment, and bioscience and healthcare. These program development activities are performed and managed solely by C&MS or collaboratively with other directorates and LLNL's DoD Programs Office. Another outcome of C&MS DoD and WFO activities will be opportunities to develop and enhance the project leadership and management skills of C&MS personnel.

The DoD Materials Technologies Leader Team: C&MS Division Leaders, Materials Program Leaders, and key program element personnel.

C&MS's current DoD and WFO portfolio is varied both in the level of funding of individual projects and range of sponsoring agencies, private and governmental.

Current DoD Technologies Office priorities include expanding programs in:

- Energetic materials synthesis, formulation, manufacturing, performance, vulnerability, reliability, storage, and demilitarization.

- All areas of CW/BW: signatures, detection, analysis, mitigation, and demilitarization; activities in this arena will focus on identifying and engaging appropriate DoD elements collaboratively with C&MS NAI MPL (Judy Kammeraad) and NAI personnel.
- DoD environmental arenas where C&MS, Energy, and Environmental directorates (and other directorates) have unique capabilities that can be coupled collaboratively to address pressing national needs in these areas; activities in this arena are performed collaboratively with C&MS E^3 MPL (Jesse Yow) and personnel from other directorates.

Other priorities include working with the relevant C&MS MPLs in identifying strategic directions and investments that can make an impact on DoD and WFO program development activities.

Staffing and Demographics

As of December 31, 1998, the C&MS workforce (by head count) is 459. This workforce is comprised of 73% career, 12% non-career, 6% post doctoral, 4% retiree, 3% student, and 2% supplemental labor (see Table 6). Table 7 shows staff profile and degree composition for career, non-career and retirees (by head count) is 407. The staffing breakdown is 62% scientists and engineers, 28% technicians, and 10% administrative and clerical.

The breakdown within the scientific and engineering disciplines is 17% physicists, 53% chemists, 19% engineers, and 11% metallurgists. About 72% of the scientists and engineers in C&MS have a Ph.D.

Table 6. C&MS Workforce.

C&MS	Heads
Career	**333**
Full-Time	322
Part-Time	10
Leave of Absence	1
Non-Career	**56**
Term (Full-Time)	29
Term (Part Time)	1
Indeterminate	6
Flex Term	20
Leave of Absence	0
Total C&MS Career and Non-Career	**389**
Post Doctorals	27
Retirees	18
Students	16
Graduate Students	1
Student Trainees	1
Summer Hires	14
Co-ops	0
Total Other Labor C&MS Employed	**61**
Supplemental Labor	9
Total Other Labor non-C&MS Employed	**9**
Total C&MS Heads	**459**

Dated: December 31, 1998.

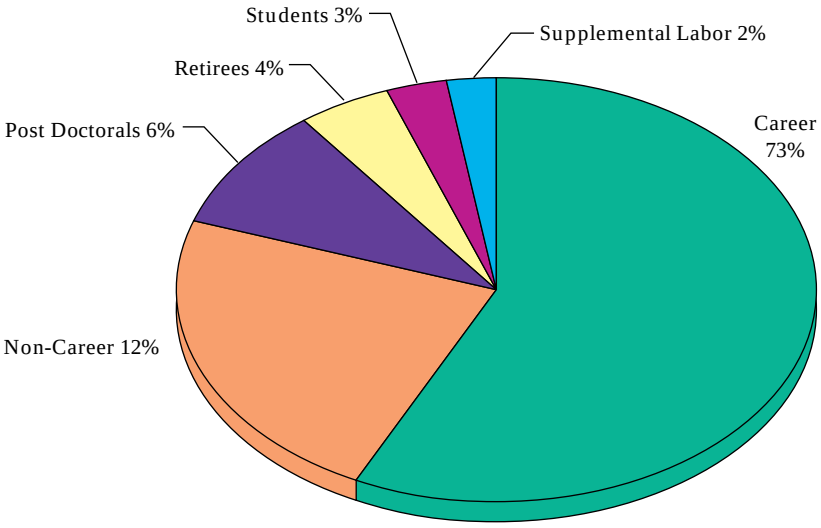
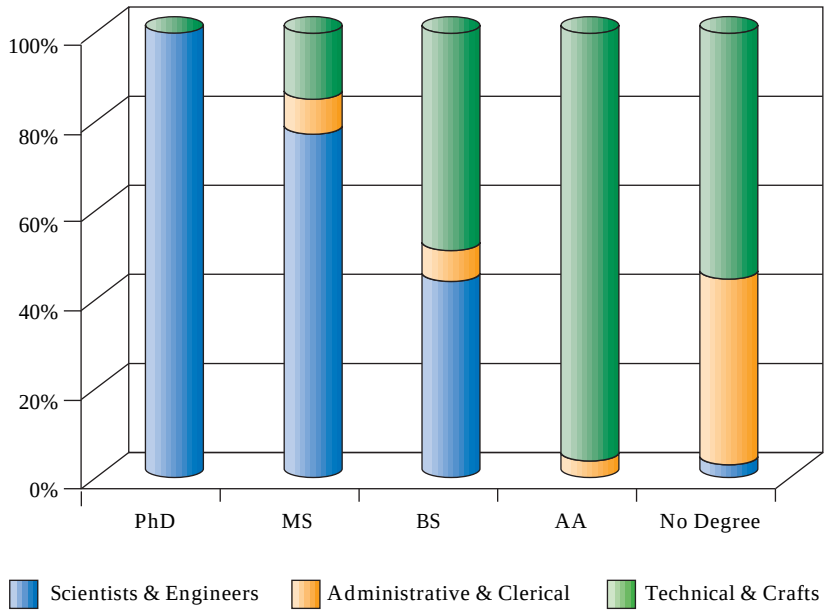


Table 7. C&MS Staff Profile by Job Title and Degree Composition.

Job Title	PhD	MS	BS	AA	No Degree	Total	Staff %
Scientists & Engineers	**184**	**31**	**37**	**0**	**2**	**254**	**62%**
Physicist—(270)	40	3	0	0	0	43	
Chemist —(242)	90	14	29	0	1	134	
Engineer—(249)	29	11	7	0	0	47	
Mathematician/Computer Scientist—(256, 285)	0	0	1	0	0	1	
Metallurgist—(265)	25	3	0	0	1	29	
Administrative & Clerical	**0**	**3**	**6**	**1**	**29**	**39**	**10%**
Management—(196,197)	0	2	0	0	0	2	
Administrative —(100-162)	0	1	3	0	9	13	
Clerical/General Services—(400-462)	0	0	3	1	20	24	
Technical & Crafts	**0**	**6**	**41**	**28**	**39**	**114**	**28%**
Technical—(302-339,347-391,502-588)	0	6	41	28	39	114	
Total C&MS Heads	**184**	**39**	**85**	**29**	**70**	**407**	**100%**

NOTE: Excludes post doctorals, summer hires and supplemental laborers.
Dated: December 31, 1998.



The scientific staff by Discipline is shown along with post doctoral labor in Table 8.

A discipline staff profile spanning ten years is shown in Table 9.

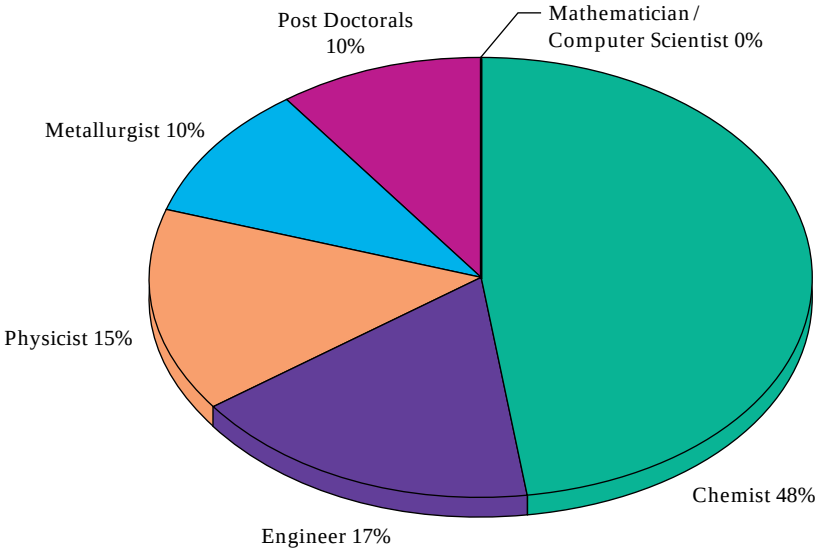
Financial and FTE Highlights

Table 10 illustrates how C&MS will be funded in FY99, summarized as follows:

Table 8. C&MS Scientists & Engineers by Discipline and Post Doctorals.

Job Title	Heads	%
Scientists & Engineers	**254**	**90%**
Physicist—(270)	43	15%
Chemist—(242)	134	48%
Engineer—(249)	47	17%
Mathematician / Computer Scientist—(256, 285)	1	0%
Metallurgist—(265)	29	10%
Post Doctorals	**27**	**10%**
Total C&MS Heads	**281**	**100%**

Dated: December 31, 1998.



Internal C&MS funding

- 53% Institutional Investment—funding comes from the Laboratory General and Administrative (G&A), Institutional General Purpose Equipment (IGPE), Laboratory Directed Research and Development (LDRD) collections, and C&MS Scientific Service Centers.
- 30% Organizational Infrastructure—funding comes from C&MS Directorate Program Development Charge (PMC), Organizational Facility Charge (OFC), and Organizational Personnel Charge (OPC) collections.
- 17% Research Projects—funding comes from Department of Energy (DOE), federal and non-federal sponsors.

Program Support Non-C&MS Funding

- 223 C&MS personnel matrixed to Programs; this translates into an approximate annual cost of $56.4K or $253K per person.

In FY99, planned C&MS managed operating and matrixed funded costs are expected to grow by 29% from FY95. In addition, the anticipated staffing level increases will be on the order of 16% from FY95 levels (see Figures 11 and 12).

Table 9. Ten-Year C&MS Staff Profile by Classification.

Year	Chemist	Physicist	Metallurgist	Engineer	Computer Scientist	Environ-mental Scientist	Post Doctoral	Tech	Admin. & Clerical	Total
1989	125	23	33	49	0	0	13	115	44	402
1990	116	22	32	50	0	0	13	111	37	381
1991	110	20	30	48	0	0	14	98	37	357
1992	85	24	28	47	0	0	20	88	40	332
1993	86	22	30	42	0	0	25	87	38	330
1994	74	17	24	38	0	0	25	81	32	291
1995	125	32	25	43	0	0	33	104	39	401
1996	127	31	22	45	0	0	29	107	41	402
1997	123	33	24	46	0	0	21	99	37	383
1998	128	39	25	45	1	1	25	113	39	417

NOTE: 1998 excludes supplemental labor, students and faculty scholar.
Dated: September 30, 1998.

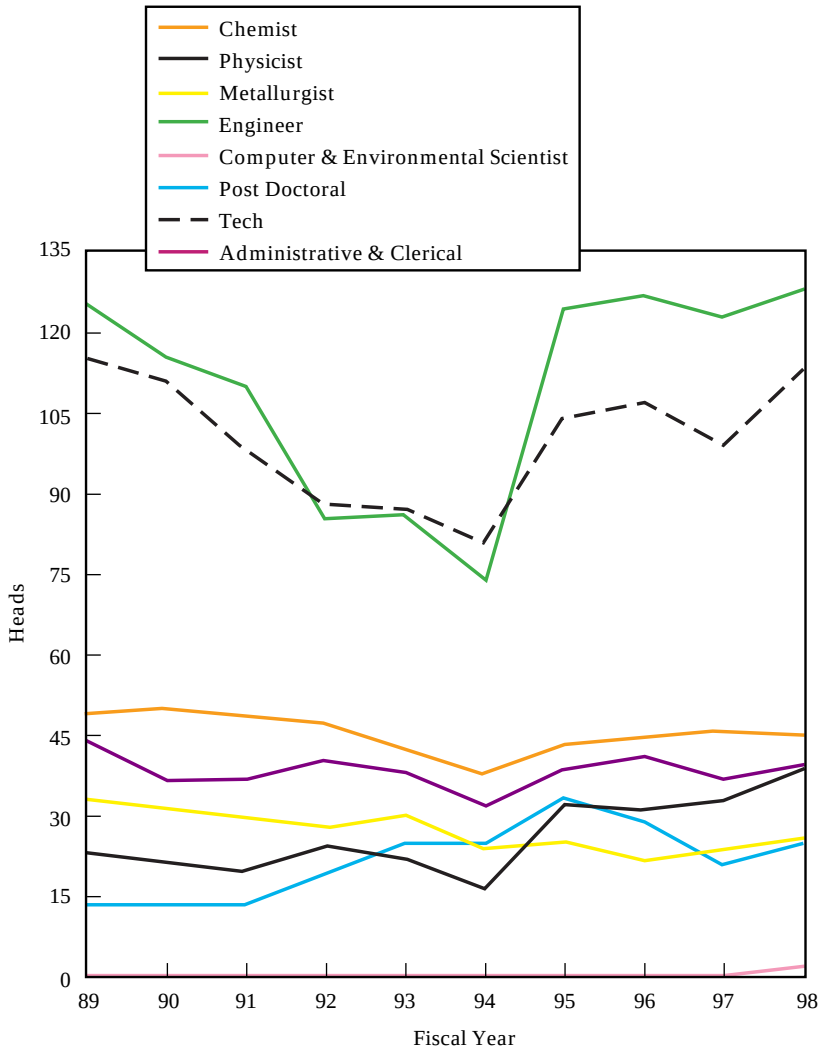


Table 10. How C&MS is funded—FY99 ($K).

• Institutional Investment

Institutional	27,487
G&A	8,009
Post Docs/Summers	500
LDRD-ERD	4,385
LDRD Lab-wide	963
IGPE-CE	1,650
Scientific Service Centers	11,980

Scientific Service Centers	
Materials Char.	2,714
ASRS	2,909
S300 HE Facility	618
CES	4,825
Nuclear Chemistry	914

• Organizational Infrastructure

Organizational	15,266
Facilities (OFC)	6,765
InfoSystems (OFC)	1,200
Personnel (OPC)	6,461
Program (PMC)	840

C&MS Cost Centers:	
Institutional	27,487
Organizational	15,266
Research	8,805
Total	51,558

• Research Projects

Research	8,805
BES	3,423
BES-CE	303
Other Direct	39
Safeguards	40
WFO	5,000

• Program Support

Non-C&MS Cost Centers:	
Matrix Personnel	56,400
FTEs	223

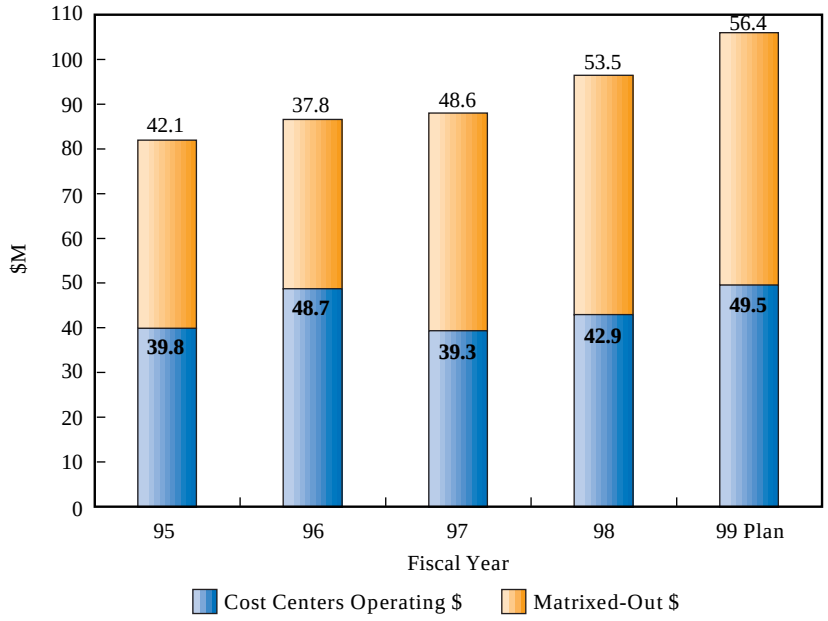
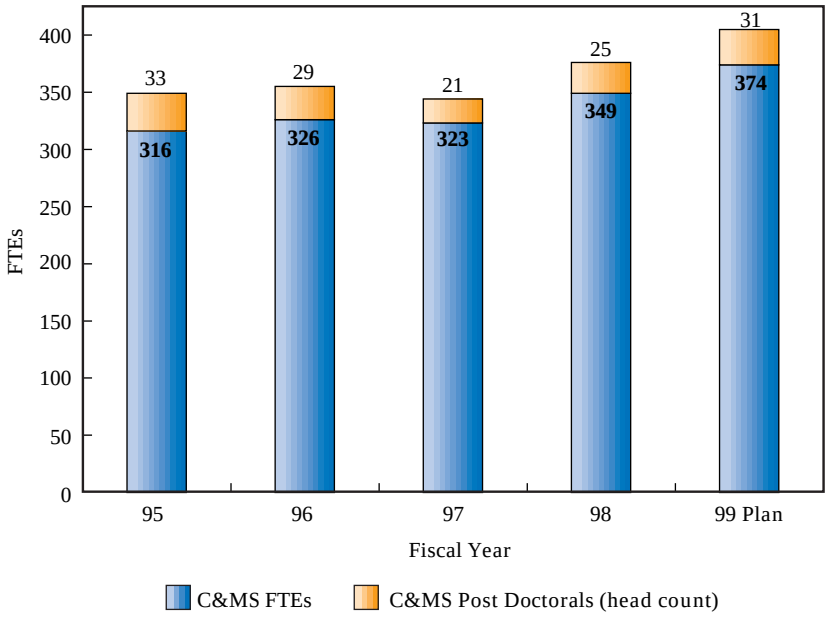


Figure 11. Five-Year Distribution C&MS Operating and Matrixed Costs.

Figure 12. Five-Year Distribution C&MS FTEs and Post Doctorals.



The Directorate primarily provides discipline personnel for support to all the Programs of the Laboratory. Support for matrixed staff to Program elements is received from other cost centers as FTE allocations rather than dollars. Institutional Investment is also considered multiprogram support. This is achieved through C&MS managed cost centers such as LDRD Scientific Service Centers, Science and Technology, and Strategic Investment. In FY98, the Directorate provided 287 FTEs (82%) to support both Institutional Investment and through the matrix (see Table 11).

A distribution of C&MS FTEs from FY95 to planned FY99, is shown in Table 12.

Tables 13 and 14 show how C&MS managed activities are supported according to funding sources. There are three categories:

- Category 1: C&MS Research Projects—consists of research projects over which the Directorate has jurisdiction. In FY98, this involved 16 FTEs of C&MS personnel and 7 FTEs matrixed in from other organizations for a total budget of $8.7M.
- Category 2: Organizational Infrastructure—consists of indirect activities involved in operating the Directorate. In FY98, this included 45 FTEs of C&MS personnel and 33 FTEs matrixed in from other organizations for a total budget of $14.2M.
- Category 3: Institutional Investment—consists of indirect activities as well as analytical and processing activities supporting scientific research at LLNL. In FY98, this included 64 FTEs of C&MS personnel and 31 FTEs matrixed in from other organizations for a total budget of $21.8M.

In FY98, the sum for the C&MS managed operating cost center was $42.9M with 197 FTEs (126 C&MS and 71 matrixed in). When added to the estimated cost of personnel matrixed (223 FTEs) to support programs, the Directorate's total operating cost was about $96.4M with a capital equipment budget of $1.8M for a total of $98.2M.

In FY99, the C&MS managed operating cost center is expected to be $49.5M with 222 FTEs (151 C&MS and 71 matrixed in). When added to the estimated cost of personnel matrixed (223 FTEs) to support programs, the Directorate's total operating cost would be about $105.9M with a capital equipment budget of $2M for a total of $107.9M.

Table 11. Distribution of C&MS FTEs in FY98.

Category	FY98 FTEs	%
C&MS Internal Projects	**62**	**18%**
C&MS Research Projects	16	
Organizational Infrastructure	45	
Institutional Investment and Matrixed Out	**287**	**82%**
Institutional Investment	64	
D&NT	89	
Lasers	47	
Energy	32	
NAI	33	
P&ST	5	
Environmental	6	
Engineering	3	
Various	9	
Total C&MS FTEs	**349**	**100%**

Dated: September 30, 1998.

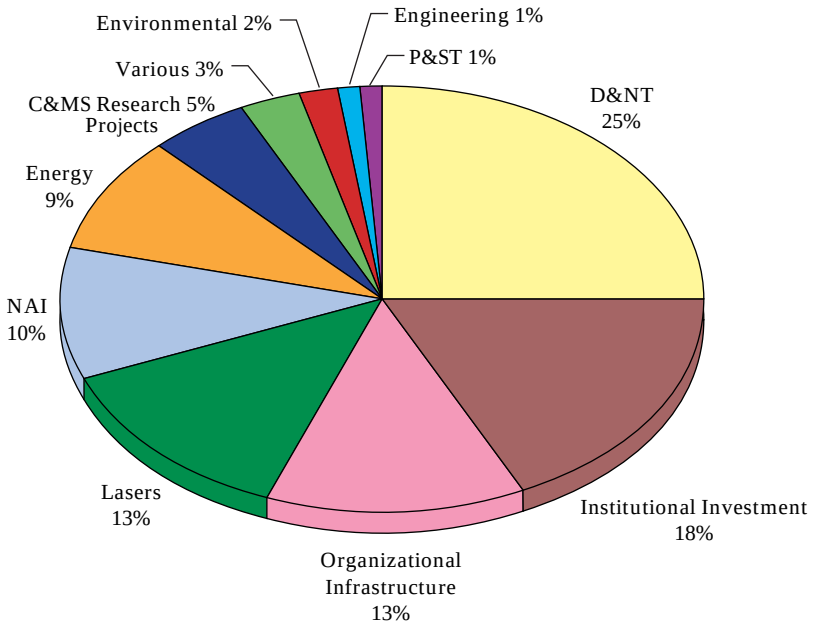


Table 12. Five-Year Distribution of C&MS FTEs.

	FY95	FY96	FY97	FY98	FY99 Plan
C&MS Internal Projects	**103**	**102**	**64**	**62**	**69**
C&MS Research Projects	40	38	20	16	18
Organizational Infrastructure	63	64	45	45	52
Institutional Investment and Matrixed Out	**213**	**223**	**259**	**287**	**305**
Institutional Investment	23	56	52	64	82
D&NT	48	56	86	89	96
Lasers	22	36	42	47	43
Energy	31	19	27	32	32
NAI	22	20	26	33	36
P&ST	10	8	8	5	4
Environmental	22	15	7	6	8
Engineering	4	3	2	3	4
Plant Ops	29	4			
Various	3	6	9	9	2
Total C&MS FTEs	**316**	**326**	**323**	**349**	**374**

NOTE: Minor variances may be due to rounding
Dated: November 30, 1998.

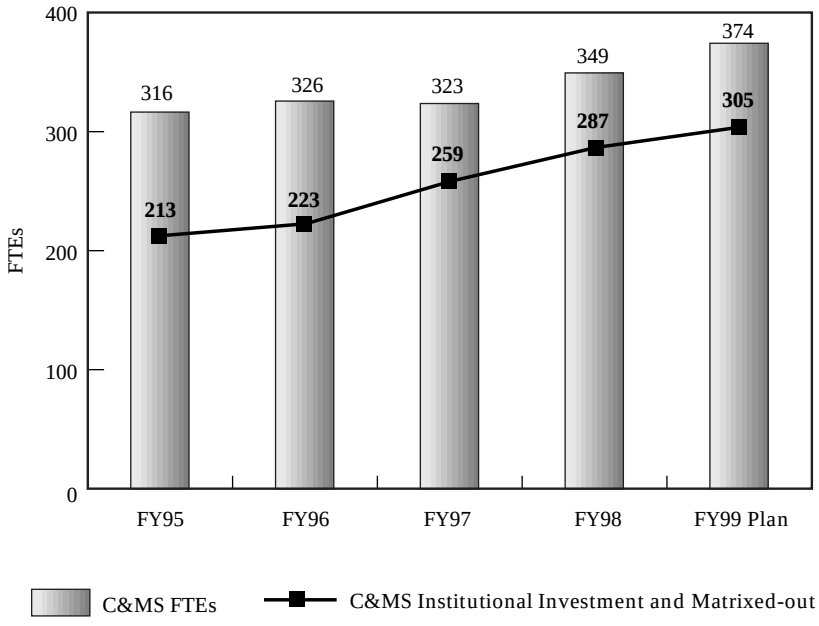


Table 13. Distribution of Operating and Capital Funds ($M) for C&MS Cost Centers.

Cost Distribution	FY95 Budget	FY96 Budget	FY97 Budget	FY98 Budget	FY99 Plan
C&MS Cost Centers	**40.6**	**49.0**	**40.1**	**44.7**	**51.6**
Category 1: C&MS Research Projects	**18.0**	**17.6**	**9.6**	**8.7**	**8.8**
DOE-Direct	**14.0**	**12.6**	**5.3**	**4.7**	**3.8**
Weapons Research & Development	6.0	5.7			
Basic Energy Sciences (KC02)	2.9	3.2	3.1	3.6	3.4
BES Capital Equipment/Fab	0.3	0.3	0.3	0.3	0.3
Technology Transfer	1.9	1.1	0.2		
Safeguards and Security	1.1	1.2	1.1	0.1	0.0
Other DOE-Direct	1.7	0.9	0.6	0.7	0.0
Other DOE-Direct Capital Equipment	0.1	0.1	0.0		
Work for Others	**4.0**	**5.0**	**4.3**	**4.0**	**5.0**
DOE	1.9	2.4	1.3	1.4	1.7
Federal Agencies	1.5	1.8	1.7	1.2	2.2
Non-Federal	0.6	0.9	1.3	1.4	1.1
Category 2: Organizational Infrastructure	**10.8**	**14.3**	**12.6**	**14.2**	**15.3**
Support Burden/OPC	5.4	5.9	4.3	5.8	6.5
PMC	0.9	1.0	1.1	0.9	0.8
OFC	4.6	7.4	7.1	7.6	8.0
Category 3: Institutional Investment	**11.8**	**17.2**	**18.0**	**21.8**	**27.5**
Overhead/G&A	6.4	6.9	6.5	7.6	8.0
G&A-Special Employee Labor		0.6	0.5	0.5	0.5
Institute Administration	0.1				
Inst Capital Equip/Fab	0.2		0.4	1.5	1.7
Scientific Services	0.9	6.1	6.1	7.6	12.0
LDRD	**4.2**	**3.5**	**4.4**	**4.6**	**5.3**
Departmental	2.3	2.3	3.6	4.0	4.4
Directors Initiative	1.3	1.0			
Lab-wide Competition	0.2	0.2	0.7	0.7	1.0
Institute - GTS ITS	0.3				
LDRD Capital Equipment	0.1	0.0	0.1		

NOTE: Minor variances may be due to rounding.
Dated: November 30, 1998.

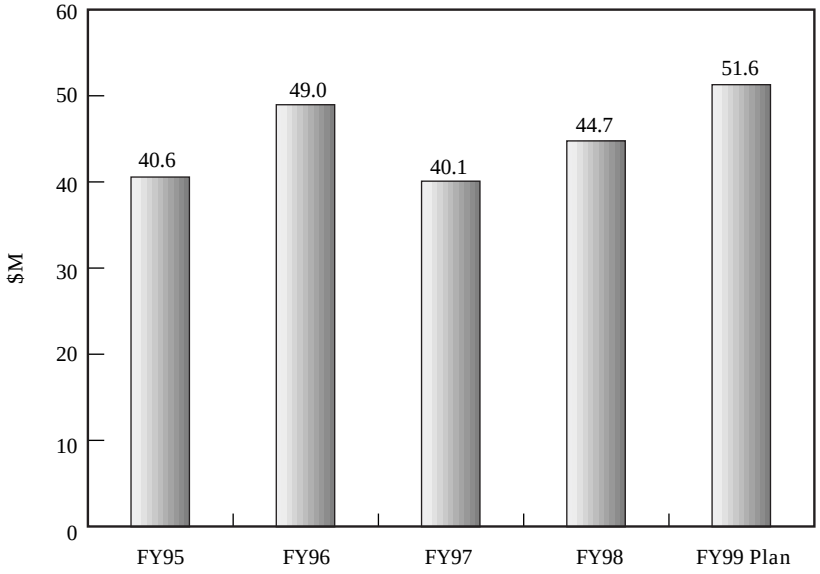
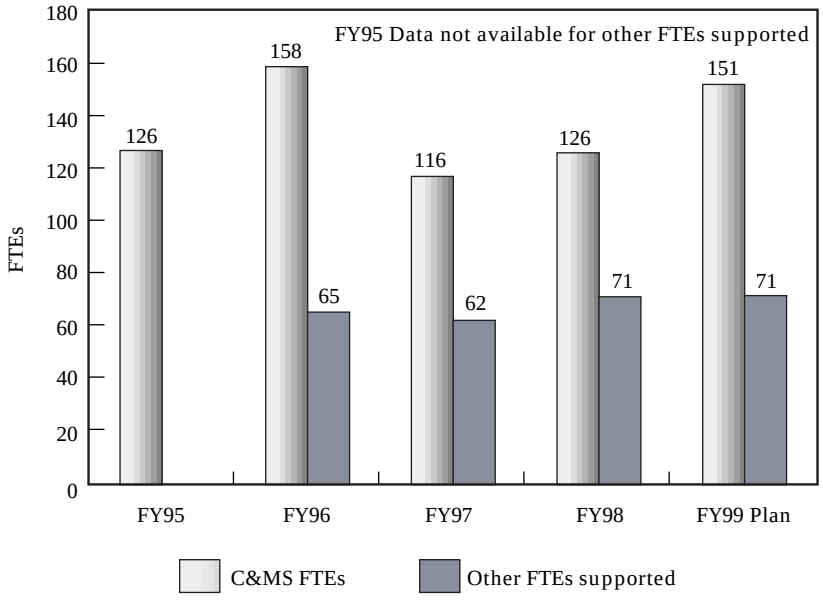


Table 14. Distribution of FTEs for C&MS Cost Centers.

FTE Distribution	FY95 C&MS FTEs	FY96 C&MS FTEs	FY96 Other FTEs	FY97 C&MS FTEs	FY97 Other FTEs	FY98 C&MS FTEs	FY98 Other FTEs	FY99 C&MS FTEs*	FY99 Other FTEs*
C&MS Cost Centers	**126**	**158**	**65**	**116**	**62**	**126**	**71**	**151**	**71**
Category 1: C&MS Research Projects	**40**	**38**	**17**	**20**	**8**	**16**	**7**	**18**	**6**
DOE-Direct	**31**	**27**	**12**	**11**	**4**	**6**	**3**	**5**	**2**
Weapons Research & Development	15	15	3						
Basic Energy Sciences (KC02)	6	6	4	6	2	5	3	5	2
BES Capital Equipment/Fab									
Technology Transfer	4	2	1	1	0				
Safeguards and Security	3	3	3	3	1	0		0	
Other DOE-Direct	2	2	1	1	0	1	1	0	
Other DOE-Direct Capital Equipment									
Work for Others	**9**	**11**	**6**	**9**	**4**	**10**	**4**	**12**	**4**
DOE	4	7	2	4	0	5	0	5	0
Federal Agencies	3	3	3	3	2	2	2	4	2
Non-Federal	2	2	1	2	2	3	1	3	1
Category 2: Organizational Infrastructure	**63**	**64**	**28**	**45**	**20**	**45**	**33**	**52**	**32**
Support Burden/OPC	53	53	4	32	1	35	4	40	4
PMC	4	5	0	6	1	5	0	5	0
OFC	7	6	24	7	18	5	28	7	27
Category 3: Institutional Investment	**23**	**56**	**20**	**52**	**34**	**64**	**31**	**82**	**34**
Overhead/G&A	10	14	9	8	23	13	19	14	20
G&A-Special Employee Labor									
Institute Administration	0								
Inst Capital Equip/Fab									
Scientific Services	4	33	9	27	7	34	8	50	8
LDRD	**9**	**9**	**2**	**17**	**4**	**17**	**5**	**18**	**6**
Departmental	5	7	0	16	3	14	5	15	6
Directors Initiative	3	2	2						
Lab-wide Competition	1	1	0	2	1	3		3	1
Institute - GTS ITS	0								
LDRD Capital Equipment									

NOTE: Minor variances may be due to rounding.
*Planned.
Dated: November 30, 1998.



Facilities Strategic Space Plan

Vision—C&MS manages facilities that support our strategic competencies, require our unique expertise, or house our research and programs. The Directorate optimizes the use and operations of our facilities to meet technical requirements, align functions, and remain cost effective.

Objectives—consist of:

- Meet Directorate strategic space requirements,
- Enhance organizational and functional alignments,
- Improve the quality of available facilities,
- Optimize space utilization,
- Reduce facility operating costs,
- Consolidate activities.

Figures 13 and 14 show C&MS progress made on Site 200 and Site 300 Facilities Consolidation and Improvement Project Plans.

Site 200 Facilities

About Site 200

Site 200 is located within the Livermore city limits on one square mile of land. C&MS facilities are in the heart of the Laboratory and all facilities are within walking distance (about 5 minutes).

Overview

C&MS has several unique chemistry facilities needed to accomplish LLNL programmatic missions. These capabilities include isotope sciences and radiochemistry diagnostics; analytical and characterization services and technology; and material and chemical process theory, modeling, and computations.

The Directorate operates 5 major facilities at the main site (B132N, B151, B154, B235, and B241). Additionally, there are 2 permanent buildings and 2 trailers within the major facility areas for a total of 9 facilities. These facilities (7 permanent

Phase 1 FY95	Phase 2 FY96	Phase 3 FY97	Phase 4 FY98/FY99
• Vacated and transferred 223, Dome, 281 • Consolidated EE, ME • Vacated and returned to Institution (RTI) 221, 227, 229	• Vacated 224, 225, 226 • Vacated and transferred 228, 1925 • Vacated and RTI or demolished 1926, 2201, 2210, 2226, 2401, 2402, 2403, 2410 • Consolidated CES into 151 Complex • Consolidated 151 Counting Facility • Rented 1526/1527 • Fielded Radioactive Inventory Tracking System (RATS)	• Activated 132 • Reroofed 151 • Replaced Chillers 151 • Upgraded Networks 151/235 • Completed Retention Tank Upgrade 151 • Restructured Facility Mgmt/Staff • Replaced 151 Hood Fan Assemblies, Smoke Detectors, Retention System, eye washes and emergency showers • Restored 151 Conf. Rooms • Revamped Safety Docs (FSPs, PWPs, PrHAs)	• Moved Directorate Office/ASD/CSD to 132N • Vacated 222, 232 and RTI • Upgraded ventilation 154 • Hired Facility Safety Manager; focus on facility ES&H/QA • Turn 235 red • Relocate materials modelers with materials experimental scientists in 235 • Move some 241 activities to 235 • B151 seismic upgrade and office/storage addition (separate project)

Figure 13. Site 200 Facilities Consolidation and Improvement Project Plan.

Phase 1 FY97	Phase 2 FY98	Phase 3 & 4 FY99 & 00
• Consolidated mgmt of chemistry and engineering process area facilities and operations • Hired new facility and operations manager; scoped S300 HE needs • Began creating and updating S300 safety documentation • Acquired 450KeV X-Ray for radiography • Acquired 25 isostatic press • Installed auto boiler blowdown system (ROI 1yr) • Upgraded tooling • Installed pilot waste water recycling unit • Sealed floors and walls • Began upgrading electronics and communications tools	• Hired Safety Manager; focus on facility ES&H/QA • Acquired film processing unit • Developed and implemented new Training Program/Plan for existing staff and development of new staff • Continued creating/updating S300 HE safety documentation • Upgraded 5lb. deareator loader • Installed 450 KeV x-ray machine • Upgraded machine controller • Replaced safety gates	• Replace machining facilities vacuum systems • Mechanize and automate process for producing mock explosives • Replace 2 vertical lathes and control systems • Acquire and install multi-axis inspection machine • Acquire twin-screw extruder • Continue machine controller upgrade • Install 25" isostatic press • Automate security gate (ROI 1.5 yr)

Figure 14. Site 300 HE Facilities Consolidation and Improvement Project Plan.

buildings and 2 trailers) represent 325,270 gross square feet (see Table 15).

For additional C&MS facilities and site development information refer to the LLNL Program Area Plan (PAP) planning document available at http://www.llnl.gov/llnl_only/plant_eng/paps/cms_pap/cmspap.html

OFC Collections

Table 16 shows who funds C&MS owned space. In FY98, Directorate collections show C&MS cost centers paid $4.4M (56%) while other Directorate Programs paid $3.4M (44%).

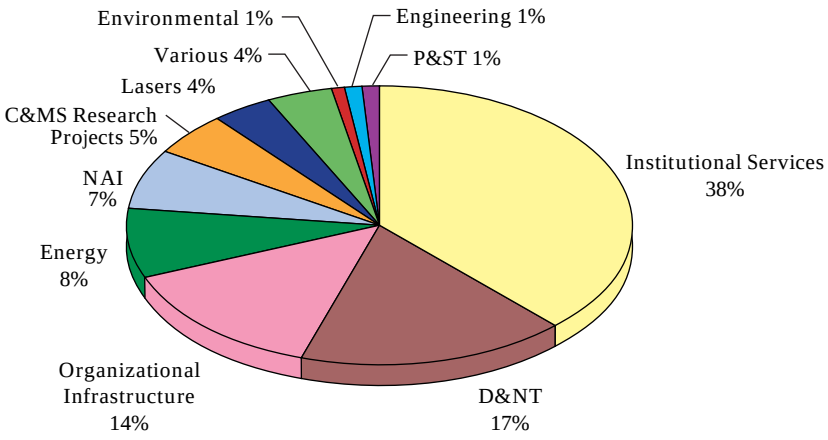
Table 15. C&MS Site 200 Facilities.

Building/Trailer	Gross sq ft
132N	66,400
151	99,303
152	751
154	9,200
235	88,732
232	2,030
241	53,990
1927	2,160
2425	2,704
Total S200 Facilities	**325,270**

Table 16. C&MS Site 200 Space—Who Pays.

Catergory	FY98 $M	%
C&MS Internal Projects	**1.52**	**19%**
C&MS Research Projects	0.43	5%
Organizational Infrastructure	1.09	14%
Institutional Investment and Matrixed Out	**6.35**	**81%**
Institutional Investment	2.91	37%
D&NT	1.34	17%
Energy	0.63	8%
Engineering	0.11	1%
Environmental	0.11	1%
Lasers	0.35	4%
NAI	0.52	7%
P&ST	0.06	1%
Various	0.33	4%
Total C&MS Space	**7.88**	**100%**

Dated: September 30, 1998.



Facilities Profile

B132N Chemistry Laboratories

Building Characteristics—consist of:

- 3 years old,
- 66K gross sq. ft.,
- Security Access: Limited,
- Wet Chemistry,
- 32 Labs,
- 6 RRPs,
- 80 Offices,
- 67 Residents.

Primary Facility Functions—include:

- Synthesis, Formulation, and Processing Chemistry;
- Chemical Analysis;
- Forensics Science.

Major Projects—include:

- In FY98 SAT relocates B222 personnel and functions, and AD staff from B235 to B132N,
- Installation of Chemical Storage Sheds in FY99,
- FY99 Retention Tank upgrades.

Facility Acquisition costs—totaling $46M:

- Facility $34M,
- Equipment $12M.

B151 / 154 Analytical and Isotopic Laboratories

Building Characteristics—consist of:

- B151 31 years old, B154 7 years old,
- 109K gross sq. ft.,
- Security Access: Limited / Controlled,
- Wet Chemistry,
- 71 Labs,
- 27 RRPs,
- 111 Offices,
- 117 Residents.

Primary Facility Functions—include:

- Isotope Sciences and Radiochemistry Diagnostics,
- Analytical and Characterization Services and Technology,
- Geochemistry,
- Stockpile Stewardship,
- Glenn T. Seaborg Institute for Transactinium Science.

Major Projects— include:

- Completion of re-roof and installation of hood fans in FY98;
- B154 Heating, Ventilation and Air Conditioning upgrade. Expected completion February 1999. Project funded ($0.5M) from General Plant Project (GPP);
- B151 Line Item (to begin in June) includes an office addition and infrastructure upgrades.

Facility Acquisition costs—totaling $63M:

- Facility $48M,
- Equipment $15M.

B235 Materials Science Laboratories

Building Characteristics—consist of:

- 11 years old,
- 91K gross sq. ft.,
- Security Access: Limited / planning for Controlled,
- Instrument Labs,
- 30 Labs,
- 16 RRPs,
- 116 Offices,
- 118 Residents.

Primary Facility Functions—include:

- Materials Development and Technology;
- Material and Chemical Process Theory, Modeling, and Computation;
- Materials Characterization Services and Technology.

Major Projects—include:

- Installation of a state of the art Transmission Electron Microscope (TEM). Expected completion February 1999.
- Partial conversion of building from Limited to Controlled in FY99.

Facility Acquisition costs—totaling $58M:

- Facility $29M,
- Equipment $29M.

B241 Materials Technologies Facility

Building Characteristics—consist of:

- 38 years old,
- 48K gross sq. ft.,
- Security Access: Controlled,
- Instrument Labs,
- 30 Labs, 1 Hi-Bay,
- 26 RRPs,
- 40 Offices,
- 47 Residents.

Primary Facility Functions—include:

- Materials Development and Technology,
- Materials Disposition,
- Materials Containment.

Major Projects—include:

- FY99 Line Item funding expected in June 1999 for the characterization and spot decontamination of B241. This will allow for better utilization of B241.

Facility Acquisition costs—totaling $28M:

- Facility $21M,
- Equipment $7M.

Site 300 Facilities

About Site 300

Site 300 is set on 7,000 acres of land about 15 miles east of Livermore (see Figure 15). It is marked by both rolling hills and steep ravines with very few trees in sight. When it was established in 1955, Site 300 was in a very remote area surrounded only by cattle ranches. It is still remote, but today the growing city of Tracy is expanding toward the site from the east.

Overview

At Site 300, C&MS facilities are divided into two groups: the Energetic Materials Chemistry (EMC) Facilities and the Energetic Materials Processing (EMP) Facilities.

The EMC facilities are used to formulate and synthesize high explosive compounds, scaleup laboratory and / or bench scale size high explosives formulations to the production scale, and to perform precision loading of shaped charges using extrusion technology.

The EMP facilities are used to produce precision high explosives parts and assemblies. The processing area facilities contain the machine tools, isostatic presses, radiography equipment and precision assembly facilities necessary for the manufacture of high explosive parts.

C&MS has several unique chemistry facilities (see Figure 16) needed to accomplish LLNL programmatic missions. These capabilities include scaleup synthesis and formulation of energetic materials, press and machine counterproliferation, stockpile stewardship, and DoD high explosive parts and radiography of high explosive parts.

Site 300 also manufactures the high explosives that are routinely used in S300 tests and prepares new formulations for specific applications. Virtually all experiments at the site study high explosives in some way. The tests study the safety of high explosives materials, their reliability, and ways to optimize the materials and manufacturing methods.

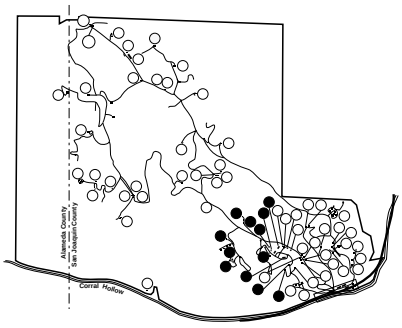


Figure 16. Site 300 Chemistry Facilities. Buildings: 805; 806 (A-D); 807; 808; 809; 810 (A-C); 813; 817 (A-H); 821; 823 (A-B); 825; 826; 827 (A-E); 828 (A-D); 829.

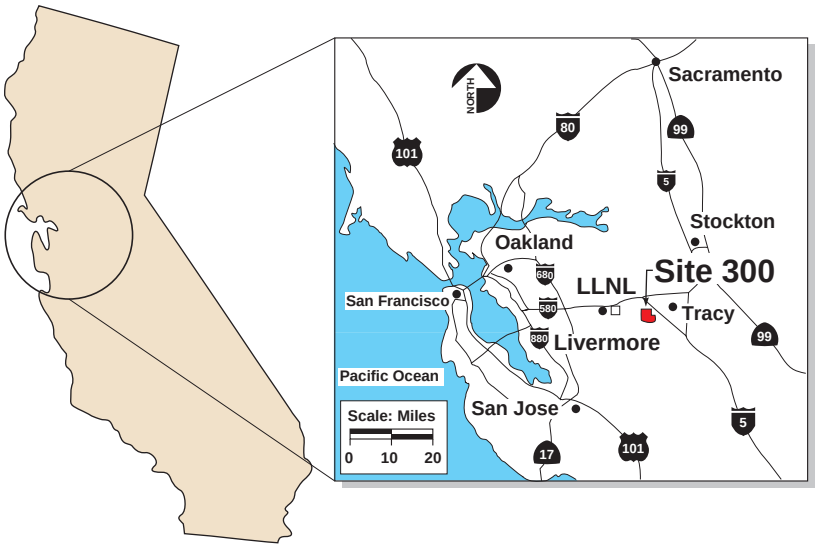


Figure 15. LLNL Site 300.

Site 300 High Explosives Synthesis & Processing Facility

Building Characteristics—consist of:

- 56K gross sq. ft.,
- Security Access: Limited,
- 19 Buildings,
- 8 Magazines,
- 15 Residents.

Primary Facility Functions—include:

- HE Synthesis, Formulation, and Processing Chemistry;
- HE Pressing, Radiography, machining, and assembly;
- LLNL Explosive Waste Storage and Treatment Facilities.

Major Projects—include:

- DOE funding received in FY98 for the Explosives Waste Treatment Facility (EWTF).

Facility Acquisition costs—totaling $33M:

- Facility $25M,
- Equipment $8M.

Research Administration and Funding

Research is considered an integral part of the Directorate's discipline development. Oversight and policy-making are vested in the AD's office. Currently, the Principal Deputy AD assumes general responsibility for administering the research effort with guidance from the AD and Consultation with Division Leaders and Program Leaders. Programs and projects are reviewed internally as well as externally.

Funding for research and development that is managed in the Directorate comes primarily from LDRD, DOE Office of Basic Energy Services (OBES), and Reimbursable / Work for Others (WFO).

Laboratory Directed Research and Development (LDRD)

The DOE has issued an Order to provide for an LDRD Program that will allow the use of up to 6% of the Laboratory's budget for discretionary research. The LDRD Program at LLNL is divided into separate funding categories:

- Exploratory Research
- Disciplines (ERD)
- Programs (ERP)
- Institutes (ERI)
- Laboratory-wide Competition
- Strategic Initiatives

The primary focus of LDRD Exploratory Research in C&MS is the support of the longer-range research objectives of the Laboratory's Programs and the contribution of new science and capabilities that influence their direction and development. These are described explicitly in the three objectives listed below:

1. Fundamental research which provides a basic scientific understanding of a specific issue faced by a Program, and acknowledged by the Program as being important.
2. Development of a new scientific capability which is likely to address problems faced by one or more Programs, or enable them to move in innovative new directions.
3. Research carried out in collaboration with a major Laboratory Program focused on winning external funding which will help support a key C&MS competency important to the Laboratory. This Program development effort is to be of such a caliber and interest to the Program that it will co-fund the development project with C&MS.

Occasionally, a relatively large C&MS project may qualify for entry into the competition for a Strategic Initiative (innovative research and development projects with significant leverage for future Programs).

The ERP category is funded by R&D collections returned to the Directorates that generated the funds. Such funds are designated to provide the technical base for developing both existing and future Programs for the Laboratory.

C&MS was funded at a total level of $4.6M in FY98 for all LDRD activities. In general, support for a project is limited to, at most, three consecutive years in this Program.

In FY99, the LDRD budgets are projected to be $5.3M. Table 17 is a breakdown of the LDRD projects and allocations for FY99.

DOE Direct

The Directorate coordinates funds obtained from the Office of Basic Energy Sciences (OBES), Division of Materials Science. Reporting, oversight, and review are carried out according to guidelines from OBES. This funding level was $3.6M in FY98.

In FY99, the OBES budgets are projected to be $3.4M. Table 18 is a breakdown of OBES projects for FY99.

Work for Others (WFO)

In general, research and development performed under

Table 17. C&MS FY99 LDRD Projects and Budgets.

C&MS Contact	Project Title	Budget ($K)
Lab-Wide Competitive		
Satcher	A New Ultrase	$162
Kinney	Systemic Adm	162
Musket	Synthesis	162
Nieh	Atomic Structure	160
DeYoreo	Materials Synthesis using Biomineral	155
Balooch	New Si Based Compound Clusters	162
	Total Lab-Wide	963
ERD		
Fluss	Fundamental Aspects of Radiation	200
Letts	High Perf. Polymide Coating	265
Tillotson	Nanostructure High Explosives	100
Fox	Chemistry & Processing of Nano…	350
Westbrook	Computational Chemistry of Plasma	105
Zaug	Kinetics of Elementary Reactions	250
DDLRubia	Effects of Radiation on Mechanical	175
Jankowski	Matl's Modification of Enhanced Gas	380
Schwartz	Grain Boundry Engineering	150
Yan	Applic. of Near Field Scanning	250
Terminello	Solid State Physics of Transuranics	245
Hamza	Novel Approaches to Surface Analysis	175
Quong	A General Method for Coupling	85
Dougan/Kammeraad	Full Volume Imaging Gamma-Ray	245
Moody	Mapping of Enhanced Nuclear Stability	250
Davisson	Diagnostic Systems	275
Hutcheon	Martian Carbonates	165
Allen	Chemical Aspects of Actinides	135
Fried	High Performance Energetic Mtls	325
DeYoreo	Optical Damage Mechanisms in KDP	160
Campbell	Validation for Mult-scale Modeling	100
	Total ERD	4,385
Total C&MS LDRD		**$5,348**

Table 18. C&MS FY99 OBES Projects and Budgets.

C&MS Contact	Project Title	Budget ($K)	Capital ($K)
Materials Science			
Newkirk	Materials Science Research Capital Equipment		$303
Newkirk	Center of Excellence Synthesis & Processing	$234	—
Howell	Positron Research	276	—
King	Adhesion & Bonding at Internal Interfaces	248	—
Nieh	Interfaces & Interphases on Superplasticity	573	—
Elmer	Kinetics of Phase Transformation	450	—
Diaz de la Rubia	Radiation Damage	320	—
Payne	Optical Materials	234	—
Howell	Positron Contract	221	—
Tobin	Investigation of Nanoscale Magnetics	450	—
Terminello / Mailhiot	Growth & Formation of Adv. Heterointerfaces	417	—
Total C&MS OBES		**$3,423**	**$303**

the auspices of other federal agencies, such as the DoD, is concentrated on technology base activities. In FY98, the Directorate reported $1.2M in costs.

In addition to WFO Federal agencies, funds are received directly from other DOE sites and from Industry. The decision to seek funding from non-DOE sources is based on Laboratory and DOE guidelines that WFO should not unfavorably impact the Laboratory's DOE mission, that the proposed work enhances or complements Laboratory Programs, that the project in question addresses an important DOE interest, or that the Laboratory possesses unique skills essential to the success of a project. The combined work for non-DOE sources, and other DOE Labs for C&MS, was $2.8M in FY98.

In FY99, WFO budgets are projected to be $5.0M.

Scientific and Technical Achievements

Table 19 lists the Directorate scientific and technical achievements for the 1998 appraisal period.

Table 19. Scientific and Technical Achievements in 1998.

Metric	1998 Appraisals
Major Awards	0
R&D 100 Awards	0
Patent Disclosures	17
Patent Applications	17
Patents Issued	9
Licenses Executed	8
Refereed Publications	162
Invited Presentations (major conferences)	66
Journal Editorships[1]	4
Conferences Organized	8
Editorial Boards	9

[1]Journal Editorships – Radiochemica Acta. Metallurigal & Materials Transactions, Nanostructured Materials, Energy-The International Journal.

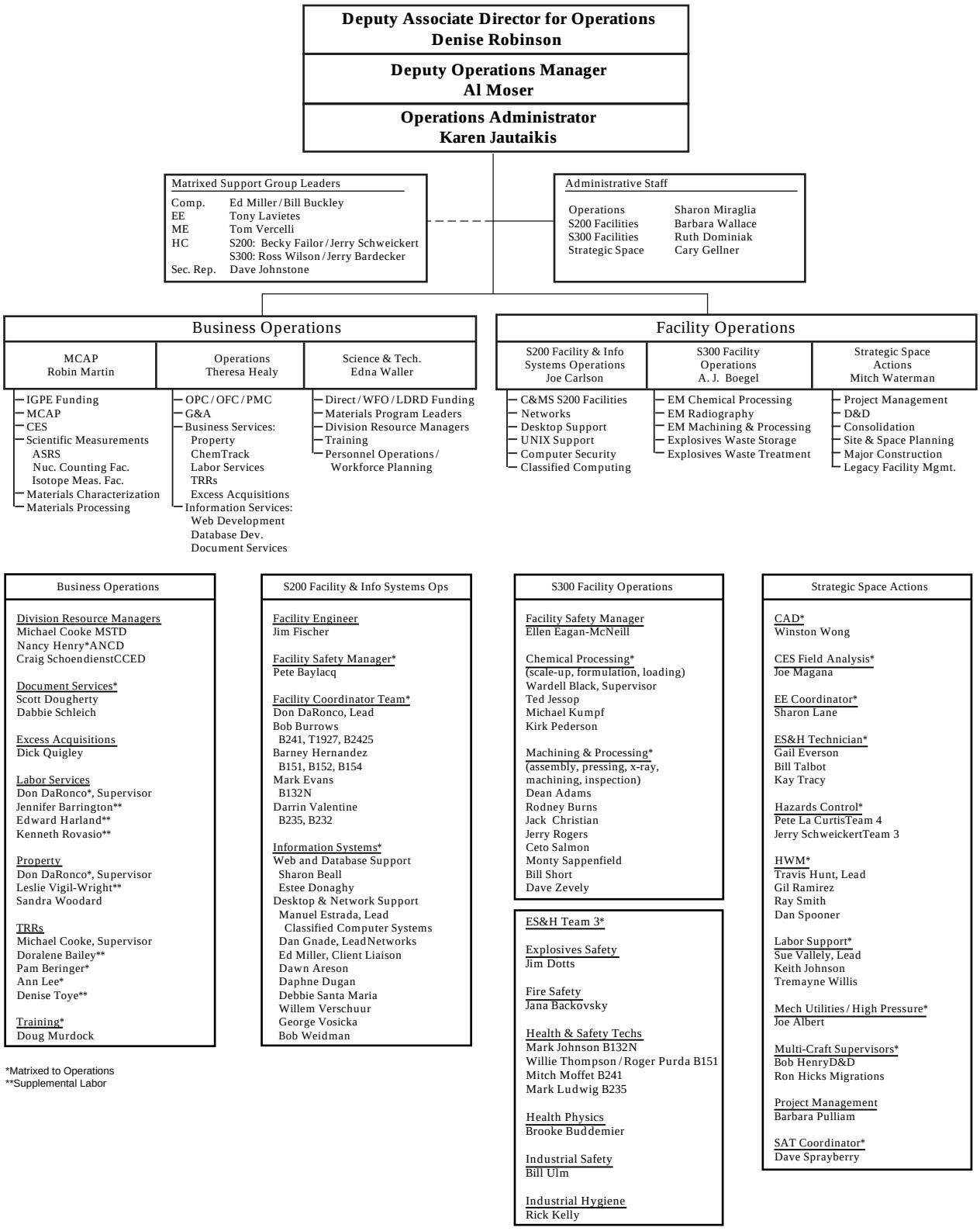


Figure 7. Organizational Chart DAD, Operations.

Analytical & Nuclear Chemistry Division

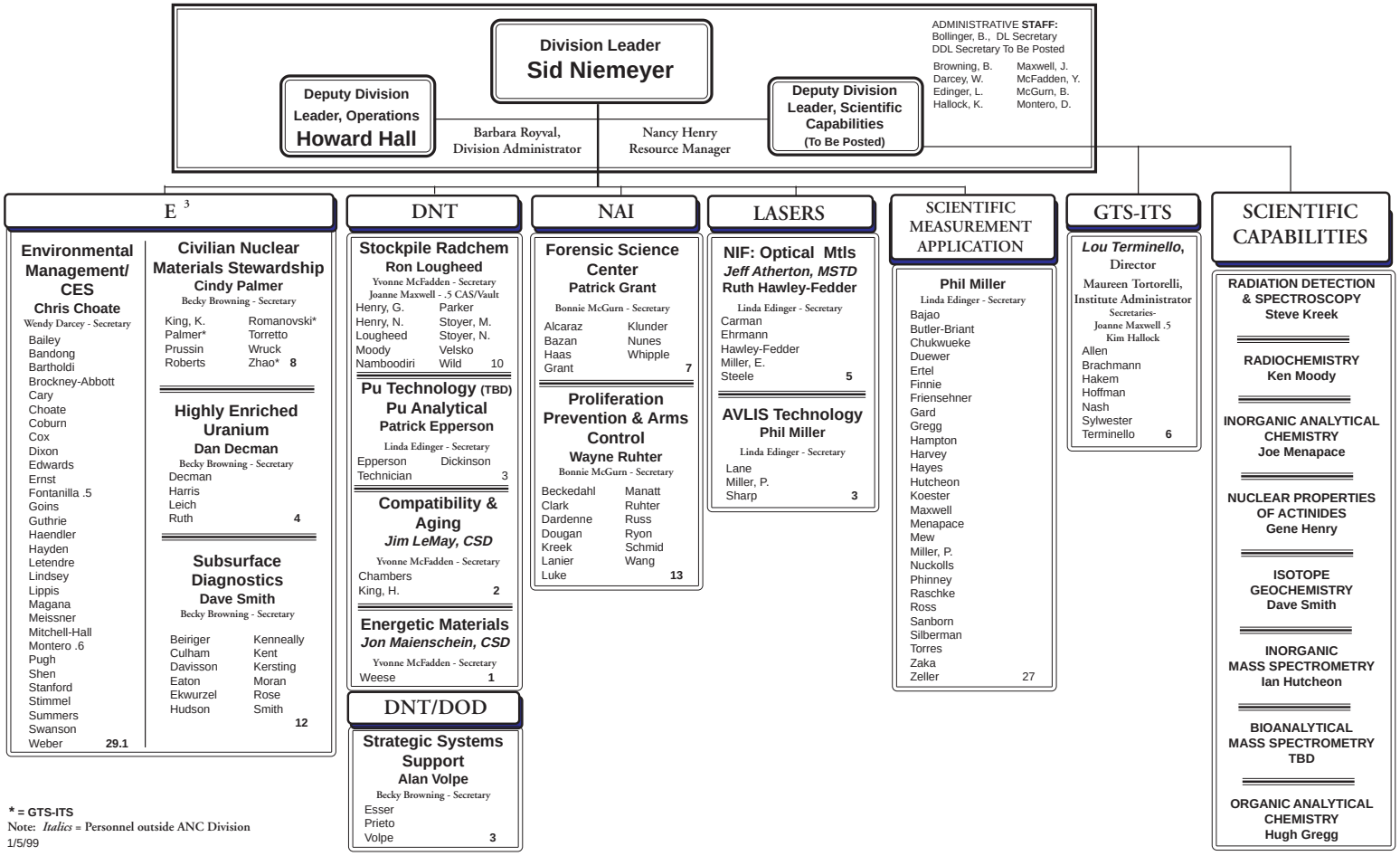


Figure 8. Organizational Chart Analytical and Nuclear Chemistry Division.

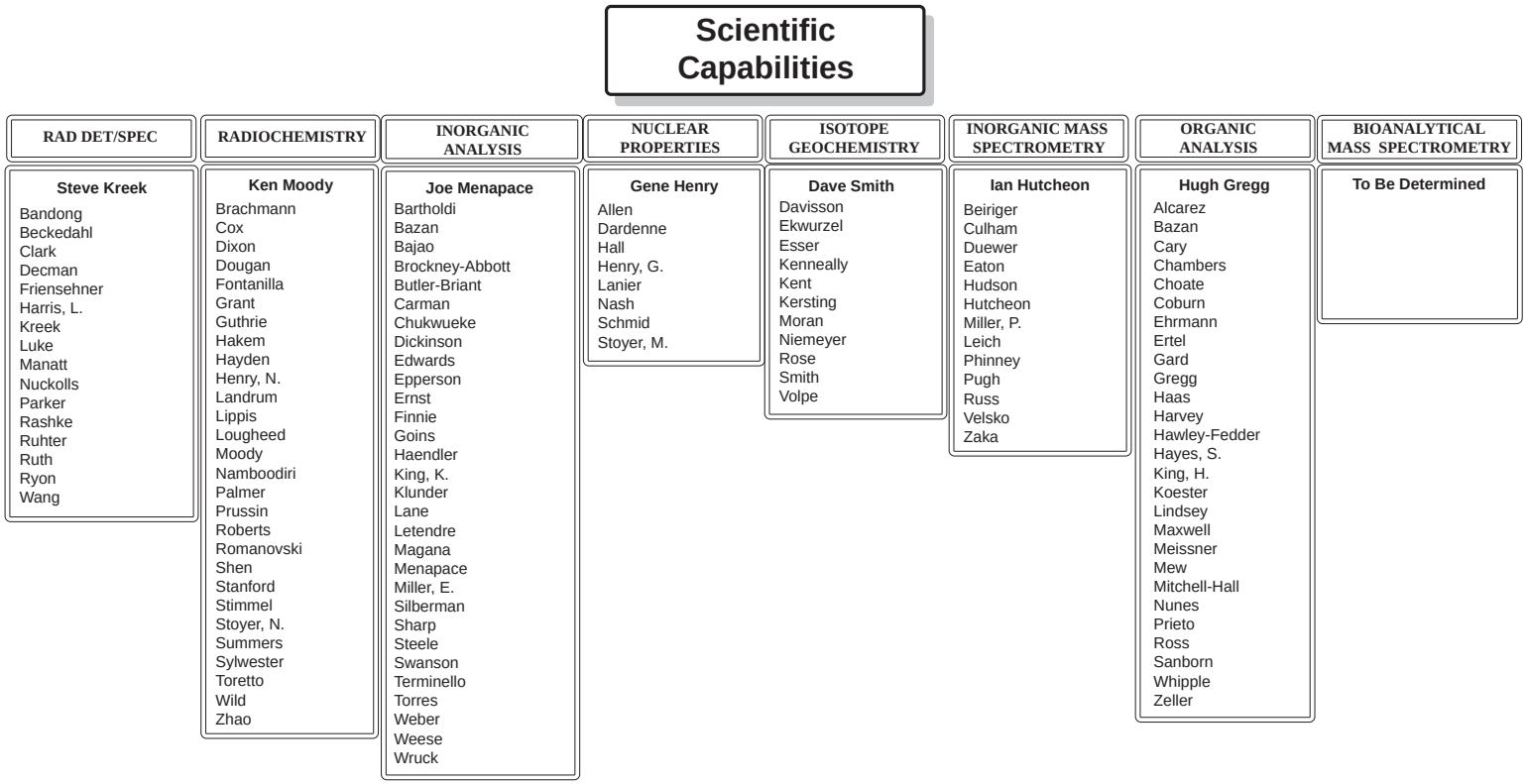
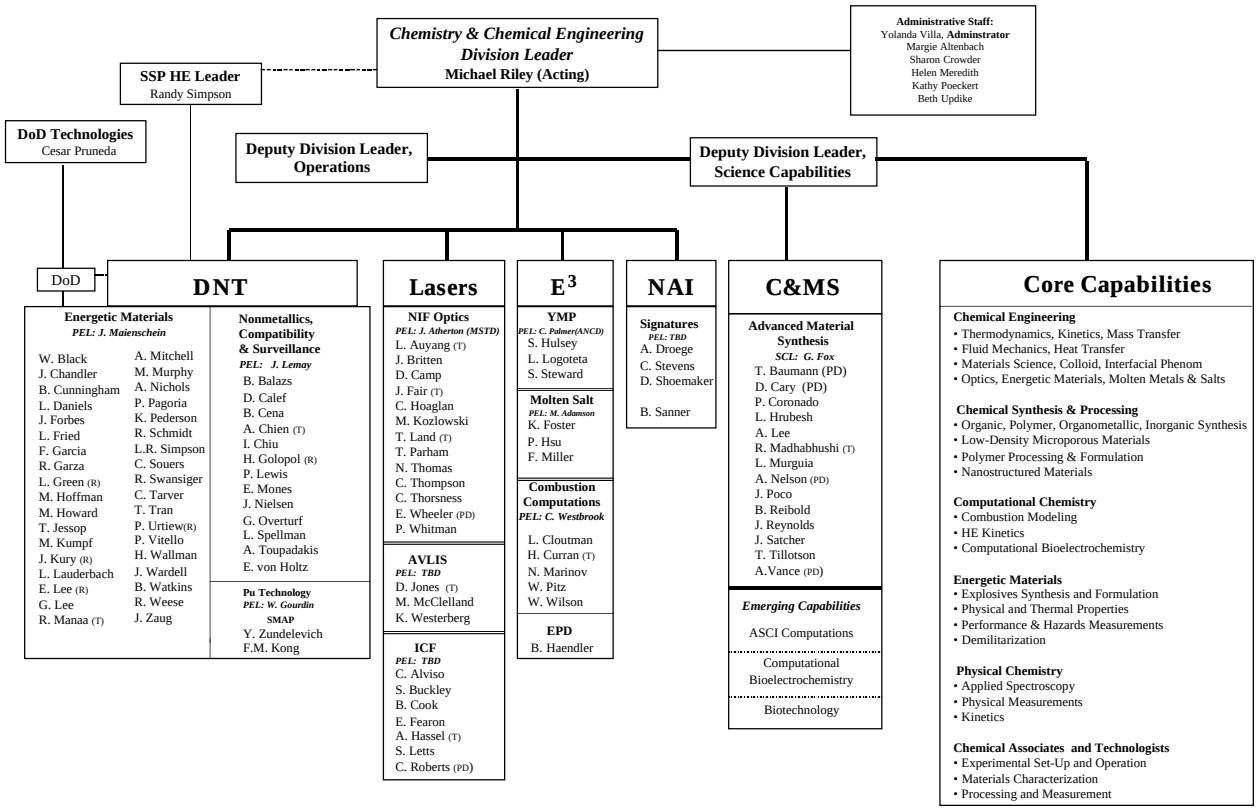


Figure 8 (continued).



C&ChED Capabilities

Chemical Synthesis & Processing
CL: G. Fox

T. Baumann (PD)
D. Cary (PD)†
I. Chiu
M. Hoffman
L. Hrubesh
J. Lemay
S. Letts
R. Madhabushi
A. Mitchell
P. Pagoria
C. Roberts (PD)
J. Reynolds
B. Sanner
J. Satcher
R. Schmidt
R. Swansiger
T. Tillotson
A. Toupadakis
A. Vance (PD)

Chemical Engineering
CL: D. Camp (acting)

L. Auyang
J. Britten
R. Cena
B. Cunningham
J. Fair
E. Von Holtz
P. Hsu
W. Hui
D. Jones
F.M. Kong
M. Kozlowski
J. Maienschein
M. McClelland
W. Miller (R)
T. Parham
D. Shoemaker
C. Thorsness
N. Thomas
T. Tran
H. Wallman
B. Watkins
K. Westerberg
E. Wheeler (PD)
P. Whitman
Y. Zundelevich

Physical Chemistry
CL: TBD

B. Balazs
A. Chien
A. Droege
J. Forbes
R. Garza
L. Green (R)
B. Haendler
A. Hassel
L. Hrubesh
S. Hulsey
J. Kury (R)
T. Land
E. Lee (R)
A. Nelson (PD)
G. Overturf
C. Stevens
S. Steward
P. Urtiew (R)
J. Zaug

Computational Chemistry
CL: C. Westbrook

D. Calef
L.Cloutman
R. Cook
H. Curran
L. Fried
M. Howard
R. Manaa
N. Marinov
M. Murphy
A. Nichols
W. Pitz
C. Souers
C. Tarver
P. Vitello
W. Wilson
J. Young (PD)

Chemical Associates & Technologists
CL: TBD

C. Alviso
W. Black
S. Buckley
J. Chandler
P. Coronado
L. Daniels
E. Fearon
K. Foster
F. Garcia
C. Hoaglan
T. Jessop
M. Kumpf
L. Lauderbach
A. Lee
G. Lee
L. Logoteta
F. Miller
E. Mones
L. Murgia
J. Nielsen
K. Pederson
J. Poco
B. Reibold
L.R. Simpson
L. Spellman
C. Thompson
J. Wardell
R. Weese

Energetic Materials*
CL: J. Maienschein

W. Black
J. Chandler
B. Cunningham
L. Daniels
J. Forbes
L. Fried
F. Garcia
R. Garza
L. Green
M. Hoffman
M. Howard
T. Jessop
M. Kumpf
J. Kury
L. Lauderbach
E. Lee
G. Lee
J. Maienschein
R. Manaa
A. Mitchell
M. Murphy
A. Nichols
P. Pagoria
K. Pederson
R. Schmidt
L.R. Simpson
C. Souers
R. Swansiger
C. Tarver
T. Tran
P. Urtiew
P. Vitello
H. Wallman
J. Wardell
B. Watkins
R. Weese
J. Zaug

*People in EMT have been double counted

Figure 9. Organizational Chart Chemistry and Chemical Engineering Division.

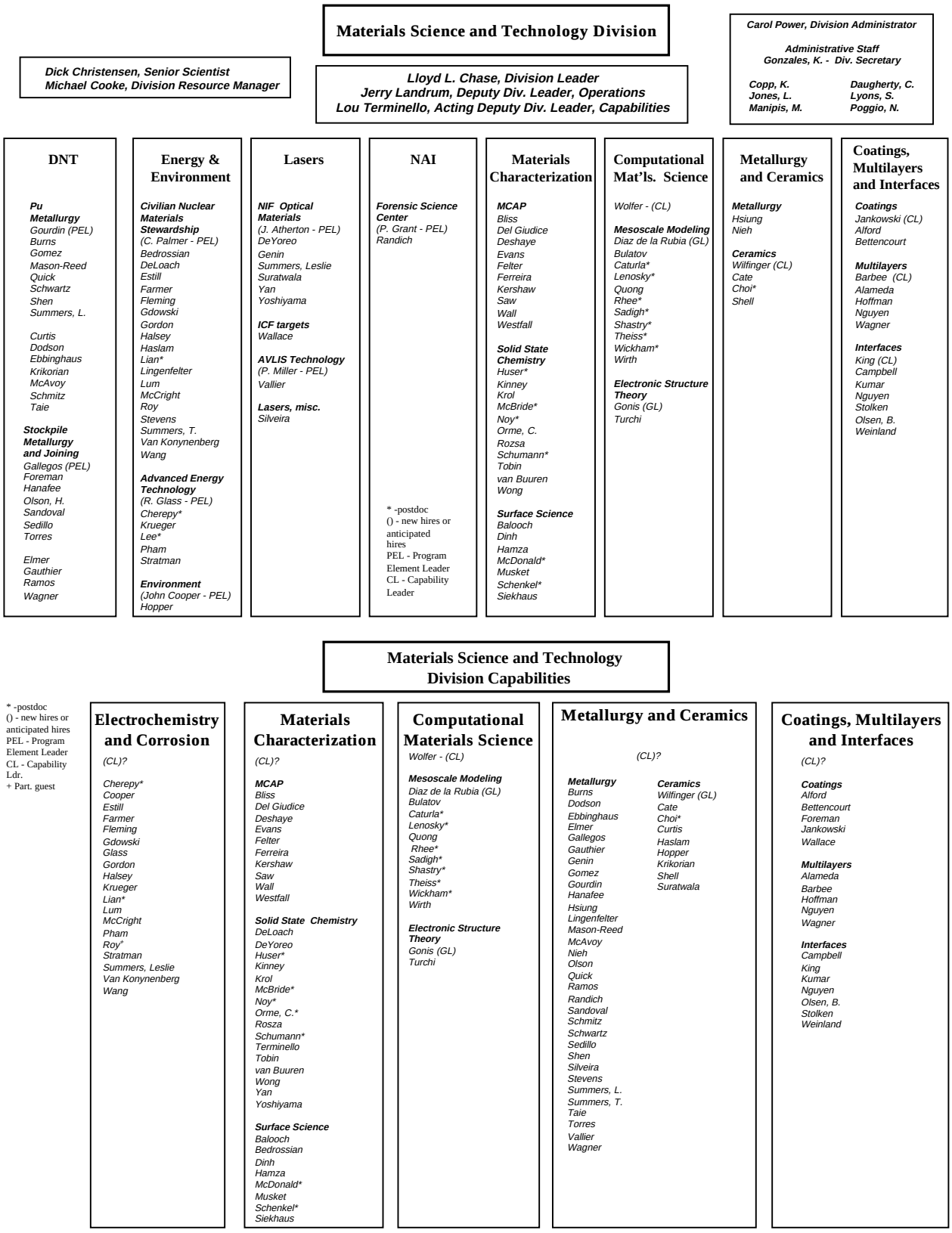


Figure 10. Organizational Chart Materials Science and Technology Division.

Acronyms

AD	Associate Director
ANCD	Analytical and Nuclear Chemistry Division
C&MS	Chemistry and Materials Science
CCED	Chemistry and Chemical Engineering Division
CE	Capital equipment
CES	Chemistry–Environmental Services
Comp	Computations
CW/BW	Chemical Warfare/Biological Warfare
D&D	Decontamination and Demolition
D&NT	Defense and Nuclear Technologies
DoD	Department of Defense
DOE	Department of Energy
DP	Defense Programs
E^3	Energy, Earth and Environmental
EE	Electronic Engineering
ES&H	Environmental Safety and Health/Quality Assurance
EWSF	LLNL Explosive Waste Storage Facilities
EWTF	LLNL Explosive Waste Treatment Facilities
FSP	Facility Safety Procedure
FTEs	Full Time Equivalents
FY	Fiscal Year
G&A	General and Administrative
HC	Hazards Control
HE	High Explosives
IGPE	Institutional General Purpose Equipment
IS	Information System Support Team
ITS	(Glenn T. Seaborg) Institute for Transactinium Science
LDRD	Laboratory Directed Research and Development Program
LLNL	Lawrence Livermore National Laboratory
MAP	Materials Analytical Programs
MCAP	Materials Computational, Analysis, and Processing
ME	Mechanical Engineering
MPL	Materials Program Leader
MPO	Material s Program Office
MSTD	Materials Science and Technology Division
NAI	Non-Proliferation, Arms Control, and International Security
NIF	National Ignition Facility
OBES	Office of Basic Energy Sciences
OFC	Organizational Facility Charge
OPC	Organizational Personnel Charge

P&ST	Physics and Space Technology Directorate
PMC	Program Management Charge
PPAC	Proliferation Prevention & Arms Control Program
PrHA	Process Hazards Analysis
Pu	Plutonium
PWP	Project Work Plan
RRP	Room Responsible Person
RTI	Returned to Institution
S200	Site 200 (Livermore Main Site)
S300	Site 300 (Livermore Explosives Testing Site)
S&Es	Scientists and Engineers
S&S	Safeguards and Security
SAT	C&MS Strategic Action Team
SSMP	Stockpile Stewardship Management Program
U-AVLIS	Uranium Advanced Vapor Laser Isotope Sciences
USEC	United States Enrichment Corporation
WFDOE	Work for Department of Energy
WFO	Work for Others